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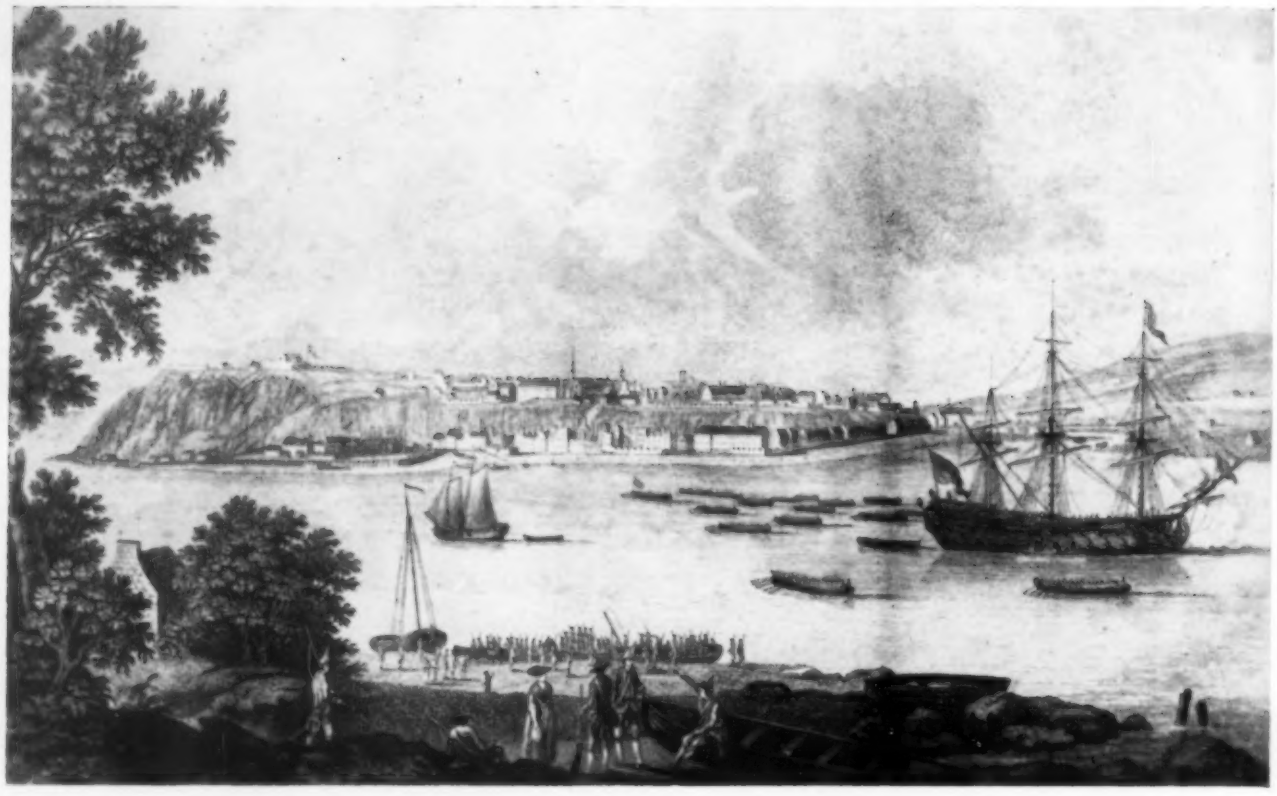


Taming The St. Lawrence

by ROBERT J. C. STEAD

Photographs by courtesy of the Department of External Affairs except where otherwise noted.

THE ST. LAWRENCE RIVER is one of the outstanding physical features of Canada. Since the earliest days it has played an integral part in the history and development of this country. By its channel white explorers, missionaries, traders, and armies of conquest first penetrated the interior; on its bosom Canada's earliest commerce was borne. When in 1534 Jacques Cartier made his way through the Strait of Belle Isle into the inland sea which lies west of Newfoundland his prow was the entering wedge of a development he could not possibly have foreseen. Happening to land on the Labrador coast on the day of the feast of St. Lawrence, he appropriately gave that name to the surrounding waters. The name has moved through the gulf and up the river until now the entire chain of lakes and rivers to the western end of Lake Superior is included in the general term, "the St. Lawrence System". Samuel Champlain, too, entered the continent by way of the St. Lawrence; in 1608 he established a fort where Quebec City now stands; in 1611 another at Montreal; and in 1615 he ascended the river's great tributary, the Ottawa. In the wake of Cartier and Champlain came the whole personnel of French settlement and occupation, and hard behind them the ships and army of General Wolfe. The murmur of the St. Lawrence runs like a symphony through all the early history of Canada.

The river is one of which any country might well be proud. With the Great Lakes and their connecting streams it affords an artery into the very heart of the continent, stretching roughly 2,000 miles from the Atlantic Ocean. It drains the largest lakes in the world; its course is marked by the most famous falls in the world, and in the river proper are obstructions which gave birth to the City of Montreal and have been major factors in the transportation problem

At top:—The St. Lawrence River at Cape Diamond, flowing past the early settlement of Quebec. From an old engraving. C.P.R.

of Canada. It is a clean river. Its cold blue-green waters are as transparent as glass. It tolerates neither the marshy shores nor muddy banks nor littered channels of less-favoured streams. And it is a well-behaved river. Due to the immense reservoir afforded by the Great Lakes, the fluctuations of its flow and its levels are comparatively small, seldom amounting to as much as six feet. Although the shores are neither high nor rocky the river is well contained; floods are unknown, except sometimes in local areas owing to ice jams. The rapids are on the magnificent scale of the river itself, in their natural state a barrier to upstream traffic; but under their white foam they conceal a wealth greater than gold—a wealth of which their discoverers never dreamed: the power to turn the wheels of industry. The benevolence of the river extends over its countryside; fertile farms and pleasant villages mark the course that was once followed inland by the voyageurs of the St. Lawrence.

Before the coming of the railways, transportation into the interior of America was almost entirely by water. Herein lies an explanation of the slow settlement of Canada as compared with that of the United States; the rivers of the Atlantic seaboard and the Gulf of Mexico suffered little from ice interruption, whereas the St. Lawrence was ice-bound from November to April. During those long winter months there was practically no communication among the isolated settlements along its shores; each had to be complete in itself, self-supporting in the matter of food, self-defending against Indians and wild animals. The pioneers entered by the river and settled by the river; the river was their one means of communication with the outside world, and, to a large extent, with each other. Small wonder that in those days while scores entered Canada, thousands entered the easily-accessible areas of the United States, establishing a lead in settlement and development which has never been overtaken.

But, even during the period of navigation, entrance by way of the St. Lawrence was not without its difficulties and hazards. At some risk of life and cargo the rapids could be traversed downstream, but on the upward trip it was necessary to portage canoes and contents around them to the calm water above. It was apparent that the solution of this problem lay in the construction of canals, if and when the population became sufficiently numerous and wealthy to support such undertakings.

The First Canals

It was not long until efforts were being made to circumvent the rapids by this means. "The earliest attempt at a canal in Canada, or in North America, was that at Lachine, early in the 18th century . . . The Welland Canal was commenced in 1824, and the Rideau Canal two years later."[1]

"The first recorded improvement for navigation in the Lachine Section was undertaken in 1700 when a canal one-and-a-half feet deep was constructed at the Little River St. Pierre, near Lachine. This was followed in 1780 and 1804 by short side canals at the edge of the rapids having two or three feet depth. The first Lachine Canal proper was built between 1821 and 1824, giving five feet of water. This was enlarged between 1843 and 1848 to nine feet. The second and last enlargement was carried out between 1873 and 1884 to provide fourteen feet depth throughout."[2]

The canals of the St. Lawrence have long been a factor in the commercial, and, indeed, the political life of Canada. Writing in 1865, William Kingsford, Civil Engineer, paid enthusiastic tribute to what had already been accomplished by the St. Lawrence canals. Said he: "We have to turn back a quarter of a century [i.e. to 1840] to note the wonderful changes which the Canadian canals have effected. All the great improvements of the province [Ontario] date from their completion. Even the introduction of steam gave but a faint impetus to progress on the shores of the western lakes. Before its introduction the country was almost out of the pale of civilization. A man leaving Toronto for Montreal looked to a journey of a fortnight. He made his will and arranged his affairs,

The largest grain vessel then on the Great Lakes, at the official opening of the Welland Ship Canal in 1932. N.F.B.

solemnly bade farewell to his family with far more feeling than a traveller in modern days would leave Quebec for Liverpool. The Durham boat in which he started was small, without accommodation, and with little to redeem its long trip; and as these small vessels approached the rapids, passengers held their breath as men do when they encounter danger . . . It was the opening of the canals which gave life and vigour to Western Canada, and the very prosperity to which they have led has made them insufficient."[3] With such advocates and such arguments it is little wonder that the canal system of the St. Lawrence has been an active factor in the Canadian economy. It is a measure of the times that instead of the original one-and-a-half-foot canal or the nine-foot channel which so excited the enthusiasm of Mr. Kingsford, a passage with a clearance of twenty-seven feet is now proposed to join the lakes and the ocean!

An International River

The St. Lawrence is essentially an international river. The Great Lakes, which provide the natural reservoir controlling its flow, are (with the exception of Lake Michigan, which is entirely in the United States) boundary waters draining from both Canada and the United States. This reservoir has a surface water area of 95,170 square miles—almost twice the combined areas of the provinces of Prince Edward Island, Nova Scotia,

and New Brunswick—and a drainage area of nearly 300,000 square miles. The boundary line follows roughly the centres of Lakes Ontario, Erie and Huron, whereas most of Lake Superior lies in the United States. At the eastern end of Lake Ontario, where the St. Lawrence proper has its birth, the land areas of the two countries converge upon each other. Here begins one of the most scenic water courses on the continent —the Thousand Islands—which stretches roughly from Lake Ontario to Prescott, a distance of about sixty-four miles. The St. Lawrence through this section has a width varying from one to four miles except when crowded into narrower channels by the low rocky islands which give their name to this part of the river. The Thousand Islands is a very popular summer resort shared alike by Canadians and residents of the United States. On some of the islands wealthy owners have built elaborate, almost castle-like summer homes, but most of them are crowned by modest cottages where medium-income people spend their summer holidays listening to the murmur of the river or exploring its waters with their motor-boats. Here the line that divides two great nations is unmarked, and islanders visit back and forth without much question as to whether they are in Canada or the United States. The international section of the river continues to a point just east of Cornwall; from there on the St. Lawrence flows through Canadian territory.

The stretch of the river known as the International Rapids Section extends from Chimney Point, four miles east of Prescott, to the head of Lake St. Francis, forty-seven miles eastwards. In these forty-seven miles the river falls ninety-two feet; it is here that the greatest obstructions to navigation and the greatest possibilities for power development occur. There seems little doubt that had this section of the river been entirely in Canada, steps to develop its power on an extensive scale would have been taken before now, but on account of its international nature such development has had to await agreement between the two sovereign nations concerned. There is little point in building a dam *half-way* across a river. As a matter of fact, some power is already developed. A diversion limited to 25,000 cubic feet per second is made on the New York side of the river and turns the turbines for 87,000 h.p. at Massena, New York State. The volume of water diverted is limited under an order of the International Joint Commission, and the water is restored to the St. Lawrence at the head of Cornwall Island. There are also a few installed developments on the Canadian side, the largest being one at Mille Roches of 2,600 h.p., and one at Cornwall of 4,000 h.p. These developments, however, are mere trifles compared with the 2,200,000 h.p. which will be produced by damming the whole river, and they make no contribution to better navigation.

Joint Action Proposed

The idea of bringing the International Rapids Section under control by joint action of Canada and the United States is not of recent origin. For nearly fifty years the two countries had, off and on, been discussing joint development of the St. Lawrence, at first mainly or exclusively for navigation; but, with increasing use and usability of hydro-electric energy, attention has turned more and more to its power possibilities. In the 1920's an international commission re-

Ships are loaded at the Government elevators at Prescott.
Capital Press Service

commended a treaty to enlarge and improve the International Section of the St. Lawrence, and in 1939 it was officially announced that negotiations were to be resumed. However, the project was again side-tracked, although President Roosevelt advocated it as a war measure, pointing out that the cost to the United States would be less than that of three battleships.

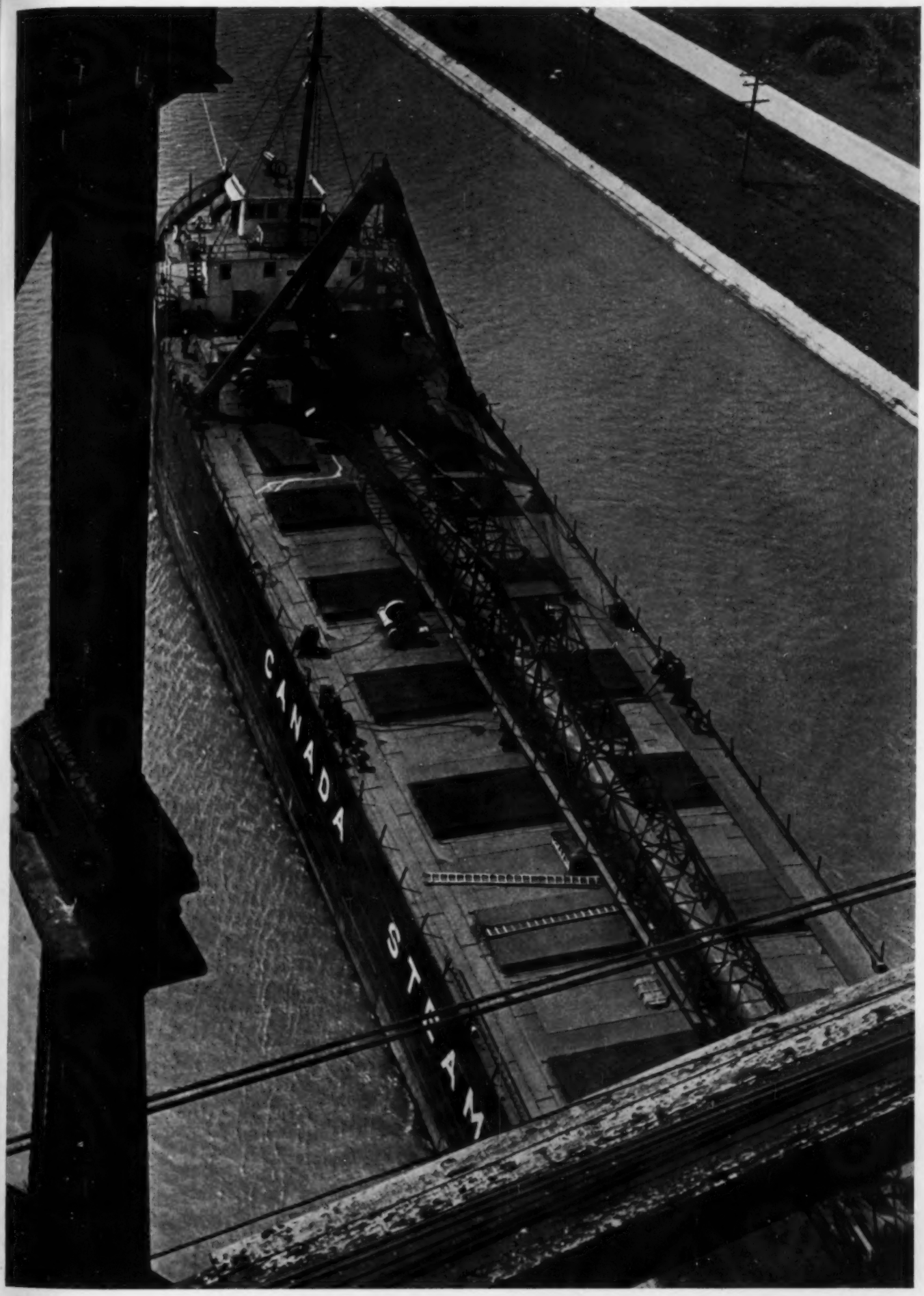
An Agreement of 1941 covering a deep waterway from Montreal to the head of the lakes was never approved by the Congress of the United States, and this lack of action resulted in Canada's withdrawing from it.

In 1952 a new approach was adopted by agreement with the United States. A joint application was made to the International Joint Commission, a body established by treaty comprising three Americans and three Canadians, for the development of power in the International Section. Canada agreed to build all the navigation facilities on the Canadian side from Montreal to Lake Erie. The application for power was approved. Meanwhile, Congress decided to participate in the sea-way. Early in 1954 it passed an act authorizing an American agency to build all the navigation facilities in the International Rapids Section in American territory. In July and August of 1954 representatives of the two countries met in Ottawa. The result: the United States is building a canal opposite Barnhardt Island in the International Section, and Canada is building a canal near Iroquois in the same section.

The estimated cost of the seaway from Montreal to Lake Erie is $305,000,000, of which $215,000,000 is to be expended by Canada and $90,000,000 by the United States. In addition, works for power in the International Rapids Section are estimated to cost $561,730,000 to be shared equally between the Hydro-Electric Power Commission of Ontario and the Power Authority of the State of New York, with the exception of power plant machinery and equipment, transmission plant machinery and equipment, and engineering, general and administration expenses. In addition to the above, Canada has spent in excess of $132,000,000 in constructing the Welland Ship Canal and for years has been investing in the improvement of the ship canal below Montreal.

The proposal for the improvement of the International Section involves damming the river a short distance above Cornwall to raise it approximately 240 feet above sea level. This is only some three or four feet below the level of Lake Ontario, this amount being allowed for the natural flow of the water through the new lake to be created. The new level will obliterate the existing fourteen-foot canals, along with the rapids above the dam, and will also flood consid-

The Welland Ship Canal at bridge number 20, looking north. N.F.B.



A freighter in the Welland Ship Canal passing under one of the vertical-lift bridges.

R. W. Harrington

The limitations of the present canal system are illustrated in this photograph taken at Dickinson's Landing. The lake freighter in the lock has only a few inches clearance.

erable areas of Canadian countryside. One of the most picturesque and historic sections of the St. Lawrence River will disappear forever from the sight of man, and in its place will be a placid lake bearing deep-draught ocean vessels and lighter craft of every description. This, no doubt, is progress as it should be, but there will be many a wistful memory of the age-old roar of the rapids which will never again be heard.

Area to be Inundated

The total area of lands that will be flooded on the Canadian side as a result of the power project currently under construction by the Hydro-Electric Power Commission of Ontario and the Power Authority of the State of New York has been estimated at 20,000 acres. Submerged will be a stretch of the present Highway No. 2, connecting Toronto and Montreal; sections of the Canadian National Railways; considerable areas of farm and orchard land; and many points of interest along the river, including the towns and villages of Iroquois, Aultsville, Farran's Point, Dickinson's Landing, Wales, Moulinette, and Mille Roches. In addition, part of the town of Morrisburg will be flooded, as practically the whole main street lies within the area to be inundated. Twenty churches and sixteen cemeteries will be affected. Many tourist hotels and stopping places — some of them fine old relics of the early architecture of the area, remodelled and converted to their present purposes — will also be under the relentless waters. However, through co-operative arrangements between the Hydro-Electric Power Commission of Ontario and federal and provincial governments, every practical step will be taken to preserve historic sites, monuments, and other tourist attractions. As well, it will be possible to move many buildings from their present locations to sites on the new shoreline.

The flooded area will cross Highway No. 2 not far to the west of Iroquois, and from there to Cornwall most of the highway will be under water. At about the same point it is also necessary to begin a diversion of the railway — the double-track line of the C.N.R. running from Montreal to Chicago. This is being moved from a point west of Iroquois to a point just east of Cornwall, where it will rejoin the existing line. The relocation will lengthen the line by about a half-mile but will give somewhat better gradients.

The new No. 2 Highway will be rerouted not far from the new shoreline to be created

by the power project, and will start just west of the new site of the village of Iroquois, rejoining the old No. 2 Highway in Cornwall itself. For a good part of its length, especially east of Morrisburg, it will run alongside the new shoreline and should offer an excellent scenic view of the St. Lawrence River in this area. In addition, for a stretch of approximately eight miles between Iroquois and Morrisburg, parts of the old No. 2 Highway that will not be flooded will be augmented by new road sections to form a scenic route along the waterfront.

The relocated railway section will run just to the north of the new No. 2 Highway. To the north of this railway section, there will ultimately be built the new four-lane No. 401 Highway which is destined to become the main artery between Montreal and Toronto. This highway will parallel the relocated No. 2 route and will be about one-half to one and one-half miles north of it.

The relocation of No. 2 highway will thus be both a loss and a gain. Like many in Ontario, it was not originally designed for automobile travel, but has been a gradual evolution from the wagon roads along the St. Lawrence first used by early settlers. It is smooth and paved, but narrow for heavy traffic; it bends sharply with the turns of the river or the topography of the land and has numerous ups and downs which obscure vision and add somewhat to the hazards of travel. But for the tourist out to enjoy the scenery it is one of the most pleasant highways in Canada. Seldom out of a full view of the river, it commands vistas of smooth water, rapid water, and verdant islands in the background, which may fairly be called entrancing. On the river rides an immense amount of shipping: freighters bound up-stream, ploughing against the current; freighters bound down-stream, slipping along smoothly and rapidly. Canals and locks appear to be under the running-board of the car, so that steamer funnels seem to rise from the solid earth; the locking-through of the ships is an unending source of fascinating interest; and clouds of smoke hanging in the distance complete a scene which, of its kind, is probably unrivalled on this continent.

The river usually flows under placid skies, smooth as quicksilver and reflecting on its bosom the cumulus clouds riding sedately in the heavens, except where it breaks cover in its eager haste, and glides and curls and foams and leaps in the incomparable rapids of the St. Lawrence. Even under darker skies it loses none of its fascination: black storm clouds veil the farther shore, lightning plays across its waters, and raindrops break the smooth glass of its surface. Such changes of mood are not for long; the storm thins or drifts away, the ships emerge from the mist, and the sun pours down with fresh brilliance through the rain-washed air. In wintertime ice forms along the shore and wherever there are spots of lazy current, while snow-storms may present a hazard even before the official closing of navigation.

A Charming Countryside

The charm of the highway is not all due to the river which it skirts. Landward are

The Galop Canal at Cardinal. This canal will continue to be used after the St. Lawrence River project is completed.

The village of Iroquois, Ontario, which will disappear when the St. Lawrence Seaway is completed. Its low-lying site will be flooded.

gently sloping fields, heavy with corn or hay crops for the dairy industry of the district, with here and there an orchard of apple trees, for this is none other than the home of the famous McIntosh Red. A memorial has been erected by popular subscription to the memory of John McIntosh whose chance seedling transplanted in 1796 became the parent of the prolific and luscious fruit which bears his name. But, although apples seem to be a natural product of the area, and in the harvest season wayside stands are red with the inviting fruit, they are not grown as extensively as might be supposed. There is no available breakdown of the actual number of apple trees on the land which is to be flooded; the nearest relevant figures are for the counties of Dundas and Stormont, and apply in each case to the whole county — not merely to the river-front. According to the Dominion Bureau of Statistics there were in 1951 in the county of Dundas 722 acres of apple orchards with 24,516 trees, and in Stormont 123 acres with 4,755 trees. Apples are therefore an incidental item in the farm production of the area, and farmers look for most of their income to corn, hay, and other field crops, and to the dairy products into which they can be converted. In view of the prospective flooding of the land perhaps this is fortunate, as field crops can be transferred to higher levels, whereas orchards can only be salvaged for wood.

Eastward from Iroquois approximately one-third of the substantial town of Morrisburg will be relocated as a result of the St. Lawrence Seaway and Power Project. As in other towns along the waterfront, the main street in Morrisburg parallels the river and contains most of the business places. At this point Highway No. 31 connects with No. 2, leading in a north-westerly direction forty-eight miles to Ottawa. Six miles from Morrisburg it passes through Williamsburg, which in the lifetime of the late Dr. Locke attracted suffering humanity from all points in Canada and the United States, and from even farther afield. Williamsburg will not be affected by the new water levels except in so far as it, like other towns a short distance back from the river, may possibly benefit from the displaced businesses, industries, and populations seeking new locations. Immediately to the east of Morrisburg is a fine old cut stone residence which had been converted into a popular tourist inn, and which will have to be sacrificed to the rising tide. Indeed, the whole route of the highway, and the area, usually narrow, between highway and river, is dotted with places, some of them quite luxurious, catering to the tourist industry, for this is one of the main arteries of tourist

travel in Canada, and in the holiday season United States automobile licence plates often far outnumber the Canadian ones. It is a curious fact that the New York side of the river does not present the same attractions; the highway does not closely follow the river as it does on the Ontario side; important centres like Massena are located only a few miles to the southward, but there is nothing of importance on the river itself.

What has been said of Morrisburg is, in the main, true of the other towns and villages along the route. The waves of progress threaten to overwhelm them. Along with the towns and villages, the farms and orchards, will go the existing system of canals. If through some unpredictable disaster in ages to come the St. Lawrence River should be drained, the people of that time will no doubt regard these submerged canals with the same curiosity as this generation feels toward the buried cities of the Orient.

The canals will have to be written off by the Government as obsolescent, just as a manufacturer writes off old and worn-out machinery when he substitutes something better. Equitable compensation will be paid those who are dispossessed of their homes, their farms, and their businesses. In the estimated cost, provision is made for these purposes. One result of the seaway development will be that the shoreline on the Canadian side of the river will be considerably lengthened. Numerous small streams and depressions now drain into the river from the north; as the river level is raised, fingers of water will reach inland along these depressions, creating permanent bodies of almost still water. In time some of these may develop beaches, in which the present St. Lawrence does not abound. It is to be expected that these comparatively still and shallow waters will be warmer than the deep and swift-flowing river. There will also be a large body of water where safe boating can be enjoyed. The tourist attractions offered by the new shore may, therefore, be not less than those of the old.

They may, in fact, be even greater, as a result of the recent formation of the Ontario-St. Lawrence Development Commission, which has as its Chairman George H. Challies, a former Hydro Vice-Chairman. The plans of this body, supplementing the building of the power project, are now gradually coming into focus, and they reflect evidence of a far-sighted recognition of the fact that progress must be measured not only in terms of industrial and economic growth, but also in the opportunities provided for recreation and cultural stimulation.

These plans envision the possibility of several thousand acres, extending from Iroquois to Mille Roches, being converted into a system of parks and roadside park areas, with an Historic Centre located at a

The seaway project will raise the water in the St. Lawrence so that the main section of Morrisburg will be submerged ten feet.

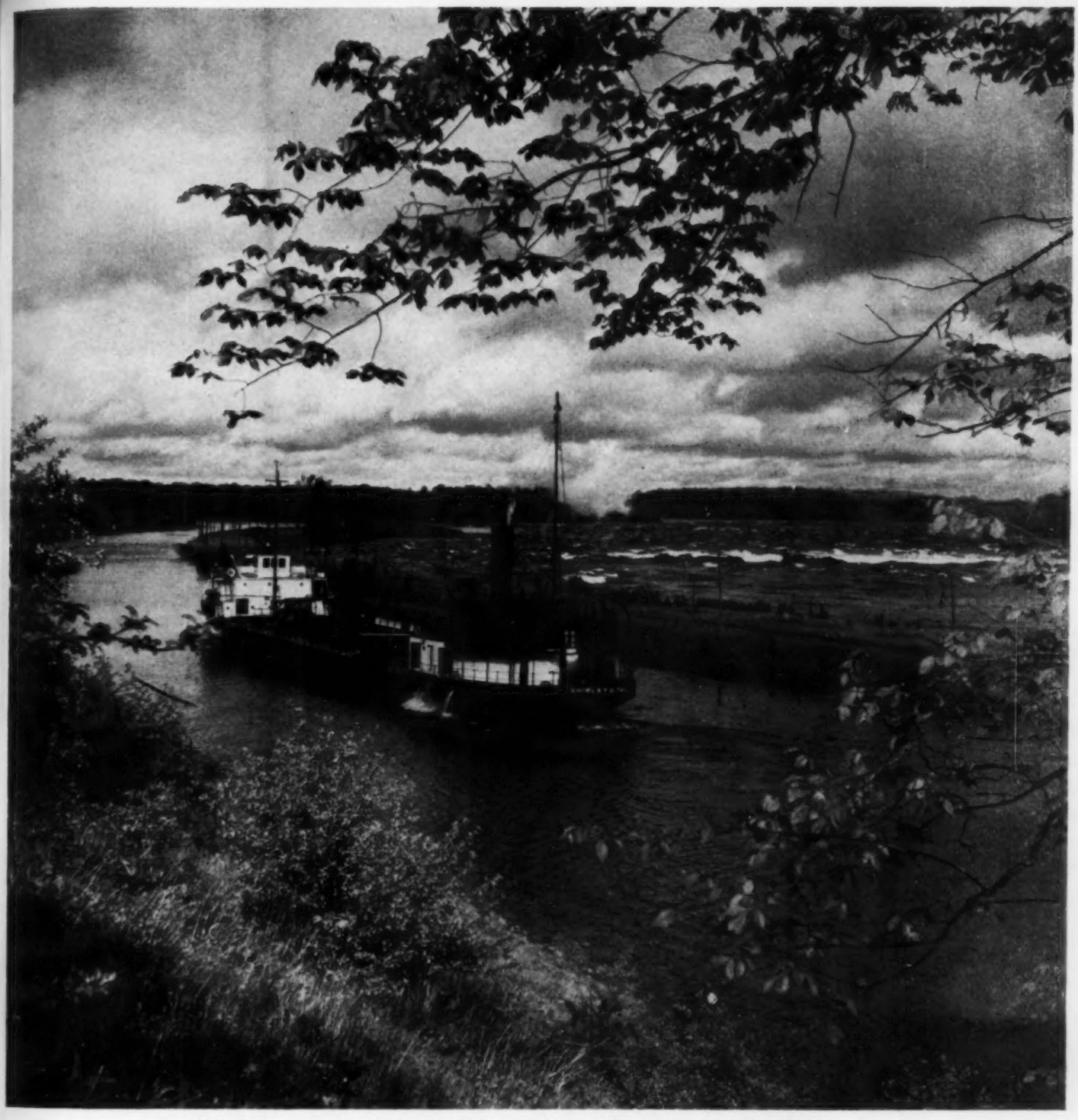
central point. The underlying principles of these proposals are that the various sites should be within easy travelling distance from the main centres of population and large enough to cater to the needs of the travelling public as well.

Lands That May Become Memories

Another result of the development seems unfortunate but unavoidable. In order to preserve some part of the Thousand Islands as a permanent heritage of the Canadian people, the Government, through its National Parks Bureau, established in 1914 the St. Lawrence Islands National Park consisting of a mainland area and thirteen islands in the river. The most easterly of these is Broder Island (shown on some maps as Canada Island) and on it rather extensive improvements have been made by the National Parks Bureau. The island is about a half-mile east of the town of Morrisburg, and has an area of seventeen acres and a maximum height of 225 feet above sea level. As the new river level will be approximately 248 feet, the result is obvious. The north side of the island rises about twenty feet above the present level of the river, and the land slopes off gradually toward the south. It is well adapted to the use of summer picnickers, being mainly open grassland but also provided with good shelter by maple, basswood, oak, elm, white birch and cedar trees. The Parks Bureau has provided two wharves on the island; also a large pavilion, a kitchen shelter, a bathhouse, and other facilities, all of which must either be removed or submerged. Other up-stream islands of the park, on which some development work has also been carried out, will no doubt serve to take its place, but campers along the St. Lawrence may well spend a few moments contemplating the fate of Broder Island.

Indeed, there will be many occasions for regretful memories. The shore of the river between Morrisburg and Cornwall, known locally as "The Front", has played no small part in the early history of Canada. Along this route came the first explorers, missionaries, and traders making their hazardous way into the unknown interior, daring the waters of the St. Lawrence and portaging where even daring would not see them through; and through the forest-clad shores were driven the first rough rudiments of what is now Highway No. 2. "The Front", separated from the United States by only a mile or so of water, was a natural place of refuge and new opportunity for the United Empire Loyalists who sought life under the British Crown after the Revolutionary War. Not only Loyalists migrated to Canada;

A farm home on No. 2 Highway near Iroquois, which will disappear when the level of the St. Lawrence is raised.



A freighter in the canal glides safely past the turbulent Long Sault Rapids.
Capital Press Service

others, concerned little with politics or sovereignty, but moved by the urge of the pioneer, crossed the river and pressed into the then almost unbroken forest.

Fantastic as it now sounds after relationships between Canada and the United States have been so thoroughly established on a good-neighbour basis that it is hard to realize they could ever have been different, the area along "The Front" was the scene of sanguinary fighting during the War of 1812. In November 1813 United States General James Wilkinson, with an army of 8,000 men well equipped for siege with field artil-

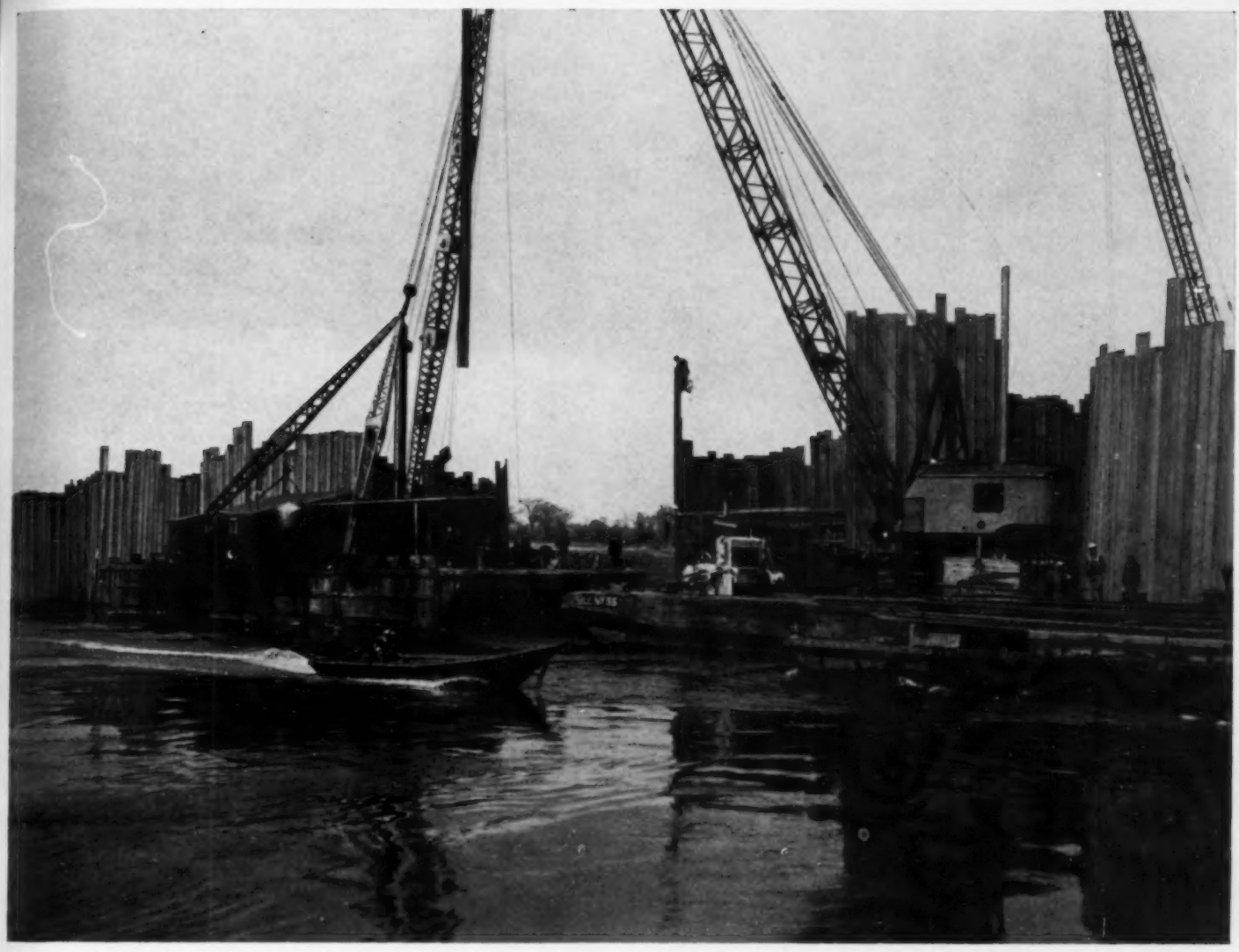
lery and transported in more than one hundred large boats, began the descent of the St. Lawrence with the avowed intention of attacking Montreal. He was followed by a Canadian force of some 900 men from Kingston and Prescott, with gunboats and three field-guns, commanded by Lieutenant-Colonel J. W. Morrison. General Wilkinson, who was in ill health, ordered General Boyd, next in rank, to attack the Canadians and capture their artillery, and the battle of Chrysler's Farm ensued. Canadian losses were 22 killed and 148 wounded; American losses were officially reported as 102 killed and 237 wounded. After the battle the American forces withdrew and the proposed attack on Montreal was abandoned. On the site of this engagement, about four miles east of Morrisburg and adjacent to Highway No. 2, a large stone column with a bronze tablet has been erected to the memory of the Canadian officers and men lost in action.[5] With the flooding of the area this monument will doubtless be moved to higher land or a new one will be erected. It marks not only the conclusion of an unhappy episode but the beginning of an era in which such things have become unthinkable.

"The Front" a Century Ago

"The Front" then, and for many years following, presented a picture very different from that of today. It was an area of pioneer living where sawmills for converting the timber of its virgin forests into lumber represented its chief industry, and the farm products were mostly grain and potatoes. No hint was visible of the diversified agriculture, commerce, and manufactures of today. It is recorded, for example, that the Township of Osnabruk, including Dickinson's Landing and Charlesville, had a population of 4,206; there were thirteen sawmills and one gristmill in the township, and the production of 1849 consisted of 33,000 bushels of wheat, 58,000 bushels of oats, 14,900 bushels of peas, 48,000 bushels of potatoes, 9,800 bushels of buckwheat, 45,000 pounds of maple syrup, 13,000 pounds of wool, and 4,000 pounds of cheese. There were small exports of horses, cattle, and sawn lumber, but there is no reference whatsoever to corn, hay, fruit, or garden products. Of Cornwall we read that it was "a neat, quiet, pleasant, old-fashioned-looking place, situated on the bank of the St. Lawrence. The streets are regularly laid out, running upwards from the river, with others crossing them at right angles, and there are several good houses scattered throughout the town. Cornwall is not a place of any great business . . . [It] remains rather stationary. In 1845 its population was about 1,600, but in 1850 the number of its inhabitants, according to the census, amounted to only 1,506".[6] There is, however, one reference much more significant than the author could have imagined. He mentioned in passing that power was being developed from the Cornwall canal! The writer no more foresaw the bustling Cornwall of today than he foresaw the St. Lawrence being harnessed to provide power, light, and heat to points many miles distant. May we philosophize that if the best brains of one hundred years ago could so little foresee the developments of the next ten decades, we today may be equally wild in our guesses and prophecies about what the next century has in store for Canada?

Diking Not Feasible

It will doubtless occur to the reader that possibly the flooding of lands along the St. Lawrence could be avoided by building a water-tight embankment from above Iroquois to the point where the river will return to its natural bed a short distance above Cornwall. Such an embankment presumably would save all these towns, villages, farm homes, and historic places from destruction. The idea has been considered, and rejected on three counts: (a) The cost would be prohibitive, running as high as $1,300 an acre for the area preserved. Land in Canada is not so scarce or expensive as to justify such an investment. Also, there would be permanent expense, not only in the maintenance of the embankment, but in pumping the drainage from the north which now runs into the river. (b) An embankment would



Tangible evidence of the taming of the St. Lawrence. Near Cornwall, construction work proceeds on the big coffer-dam for the Hydro-Electric Power Commission of Ontario.

Capital Press Service

not preserve the places of interest or value along the river; they are mostly so close to the present water's edge that they would either be in front of the embankment or buried under it. (c) There was a psychological problem: the people of the area are not accustomed to living under the river level and would not have accepted such a condition. They have read and heard too much about the damage done and the lives lost along the Mississippi when embankments give way.

When the St. Lawrence project is completed, the pleasant land between Iroquois and Cornwall will be forever veiled from the sight of man. It will not go without regrets. Here men and women have wrestled with the forests; here the roar of the rapids has sounded from time immemorial; here children have been born and parents have gone to their last heritage; here, long ago, cannon and musket-fire proclaimed the bitter futility of war; here a peaceful countryside has nurtured industry and commerce and, to some extent, a culture of its own. But the gods of Power and Commerce beckon onward in the name of Progress, and who shall say they can be denied ?

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4. Department of Transport, Ottawa.
5. Information from the National Historic Sites and Monuments Board, Ottawa.
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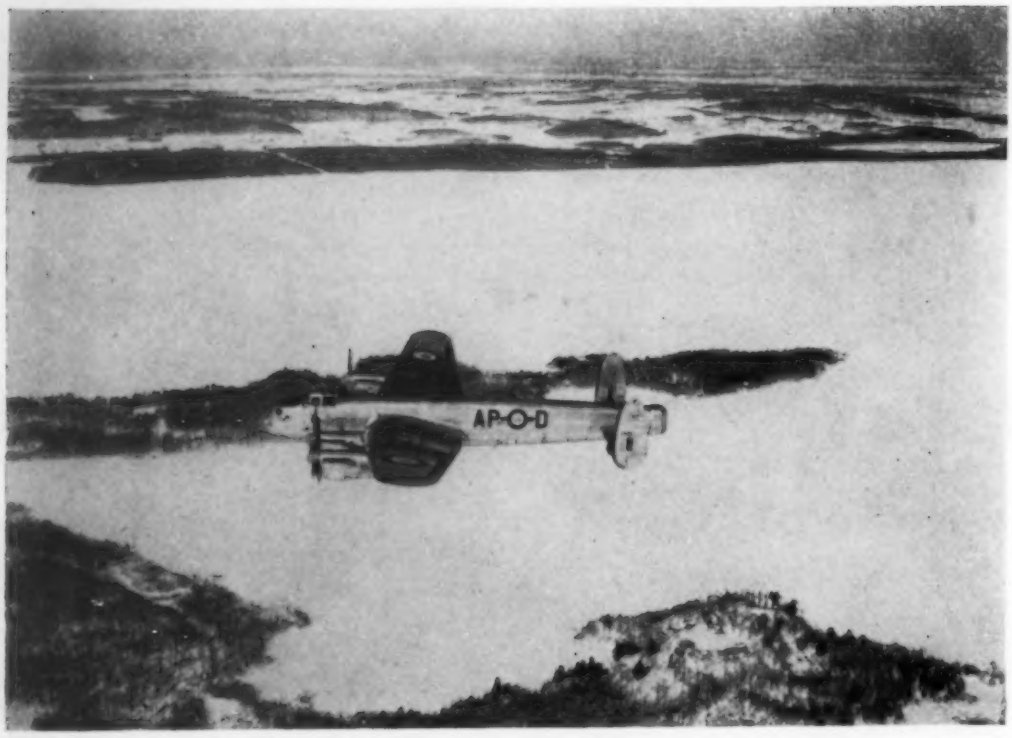
Acknowledgment is made to the Hydro-Electric Power Commission of Ontario for assistance with technical points in this article.

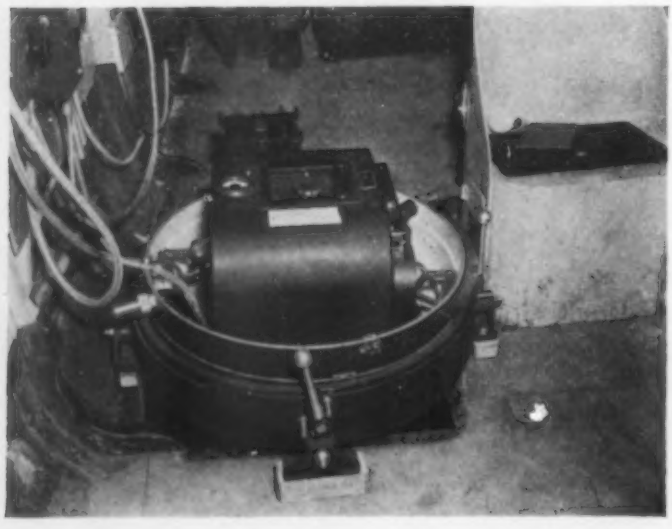


Maps of large areas are based on aerial photographs. A famous Canadian bomber used in aerial surveying. R.C.A.F.

The Role of Photography in Canadian Mapping*

by JANUSZ J. KLAWE

THERE IS an interesting map of the world, published by the United Nations in *Modern Cartography*, 1949, which shows the extent to which the various countries have adequate map coverage. Great Britain and most of Europe are covered with solid red, indicating that they have been thoroughly mapped. Canada, on the other hand, is shown with only a very slight blush. This distinction is no dis credit, it simply reflects two outstanding characteristics of Canada — its vastness and its newness in terms of settlement. However the realization of the potential resources of Canada and their rate of development have increased remarkably in recent years. The importance of the map in their further satisfactory development cannot be over-emphasized.



The interior of a photographic aeroplane, showing the back of a vertical aerial camera. R.C.A.F.

In this second half of the twentieth century we accept technical progress very easily. We have been spoiled by the rapid steps made in technology. However, it may be beneficial and interesting to reflect from time to time on these technical achievements which we take for granted.

Let us consider any one of the 1:50,000 maps of Canada (National Topographic Series). Each map covers an area of approximately 23 by 17½ miles. Depending on the part of the

country which the map covers, it may include hills and depressions; a sea, lakes, rivers and streams; forests, prairies and swamps; hundreds of houses; miles of roads and tracks; dams and rapids; one or two railroads, power transmission lines, pipe lines; elevators; water and oil tanks, and so on.

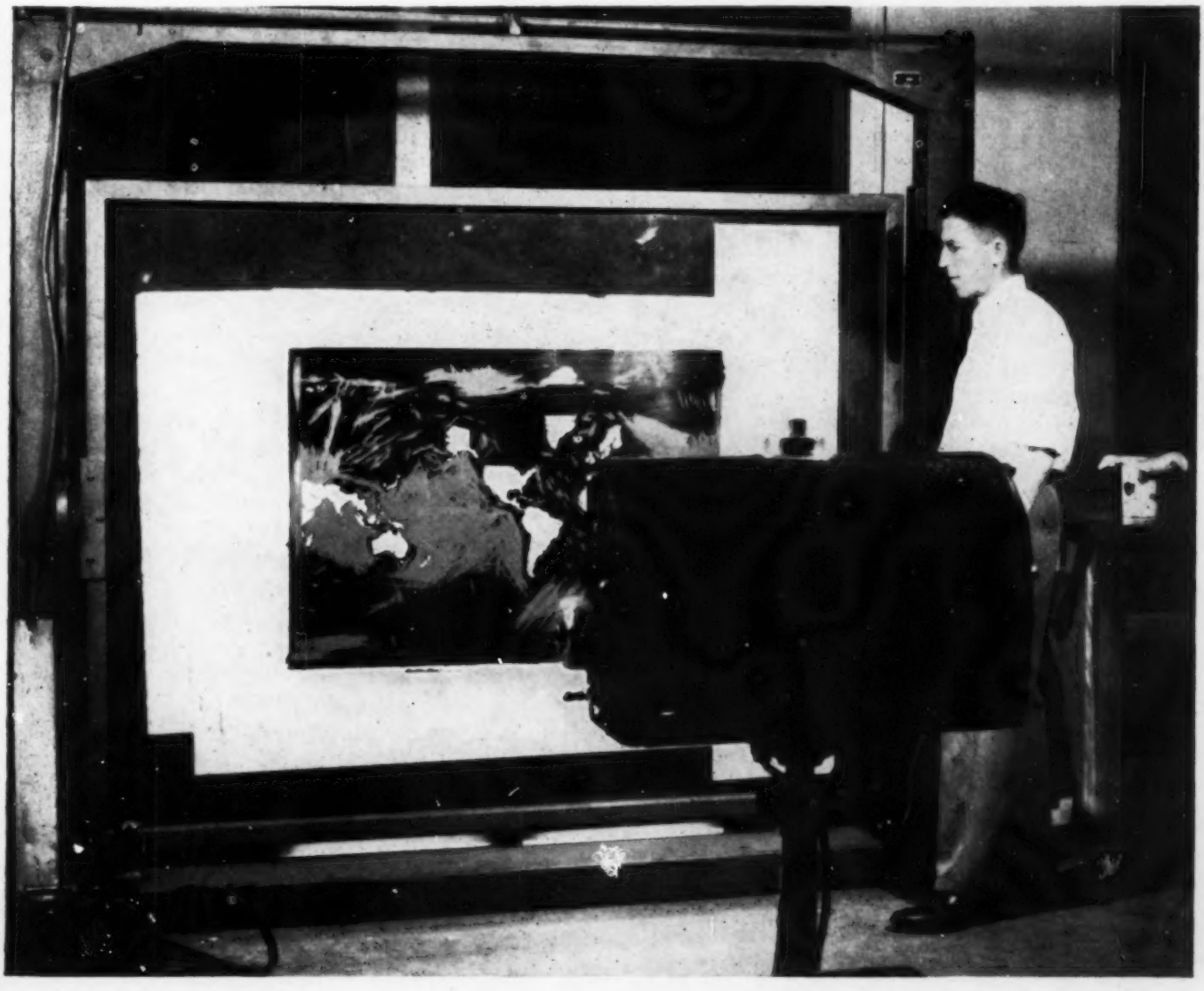
When one considers that each map will include all these details and others (together with the elevation contours), that each detail is to be located in its exact relative and geographical position, that the map will be one of several hundred new maps published each year in editions running to a few thousand copies, and that the staff employed in mapping is relatively small, then one may indeed ask what developments in technology have made this possible.

The answer is to be found in the application of photography to mapping. If maps could write letters, they would sign them "Photographically yours".

Photography means drawing with light, with or without the medium of the camera.

The mapping organizations in Canada started to employ photography relatively soon after its introduction. This probably happened thanks to Deville, who came to Canada from France, where the first experiments in the application of photography to mapping were made about 1840. As early as 1886, during the mapping of the Rockies, ground photography began to be used. In the early nineteen-twenties the camera was taken into the air and a great variety of photographic perspectives were used

An elaborate photo-copying frame, equipped with a vacuum pump to assure perfect contact between the large negative (positive) and copying medium. A strong arc light is used for exposures.
Mines and Technical Surveys Dept.



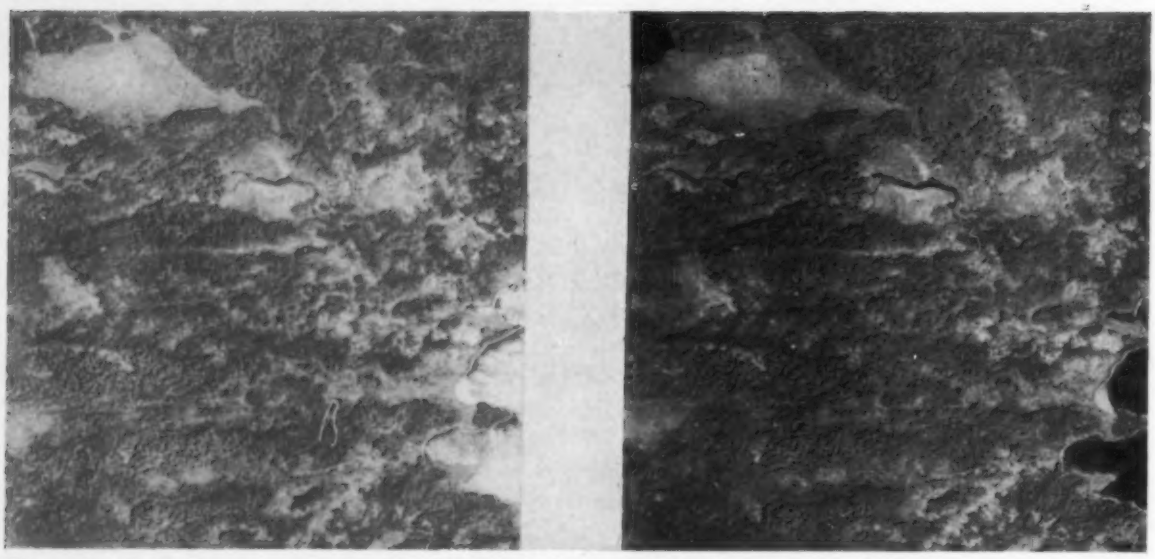


Figure 1:—Part of a stereoscopic pair of vertical photographs. The area mapped from this part (a section of Newfoundland) is shown in Figure 2. R.C.A.F.

in aerial surveying. Even today in the text books on photogrammetry one can find the description of the Canadian Grid as it was applied to solve the perspective of a high oblique aerial photograph. Since that time aerial photographs used singly or in combination have become the standard method of surveying large areas.

The value of photography in mapping, however, is not limited to photographing the terrain to be mapped. Its many uses can be grouped into two sections, which we shall illustrate in terms of the 1:50,000 map. These are: (a) Compilation of the manuscript; (b) Reproduction.

(*a*) *Compilation of the manuscript*

The purpose of the aerial photograph is to provide information about the terrain to be mapped. The great asset of the aerial photograph is the speed with which this information can be obtained (viz. a 9″ x 9″ photograph at a scale of 3,300 feet to an inch covers an area of 30,000 by 30,000 feet).

In Europe aerial photography came into use after a solid and dense net of ground control had already been established by conventional survey methods. In Canada there is no such extensive system of ground control which is necessary for the required orientation of the photographs in relation to the ground. It will be a long time before the conventional ground control, which can only be obtained by ground survey methods, covers the expanses of Canada. This work is being speeded up by the use of electronic methods for measuring distance. Photography is often used to identify the site of the chosen ground control position.

Once the aerial photograph has been taken and tied to the terrain by identifying on it the ground control point, it remains to produce a map from the photograph.

A photograph presents an image on a scale which is not uniform throughout. The scale varies with the distance between any part of the object photographed and the camera. An amusing illustration of this fact is the well known photograph of the policeman with the enormous hand stopping traffic. This apparent distortion is inevitable, according to the laws of perspective, when a projection is made through one point, the camera's lens in our case. It is these differences in scale which prevent a photograph from being a map.

These same differences, however, are used to great advantage to build up a stereoscopic model of the photographed terrain. When the same area is photographed from two different points, the distances from the same points of the terrain to the two positions of the camera will differ. Thus two distinct perspectives

Figure 2 (opposite):—Section of the 1:50,000 map, showing part of Newfoundland. The large rectangle indicates the approximate area covered by one stereoscopic pair of photographs. The smaller rectangle corresponds to the area in the photographs in Figure 1.

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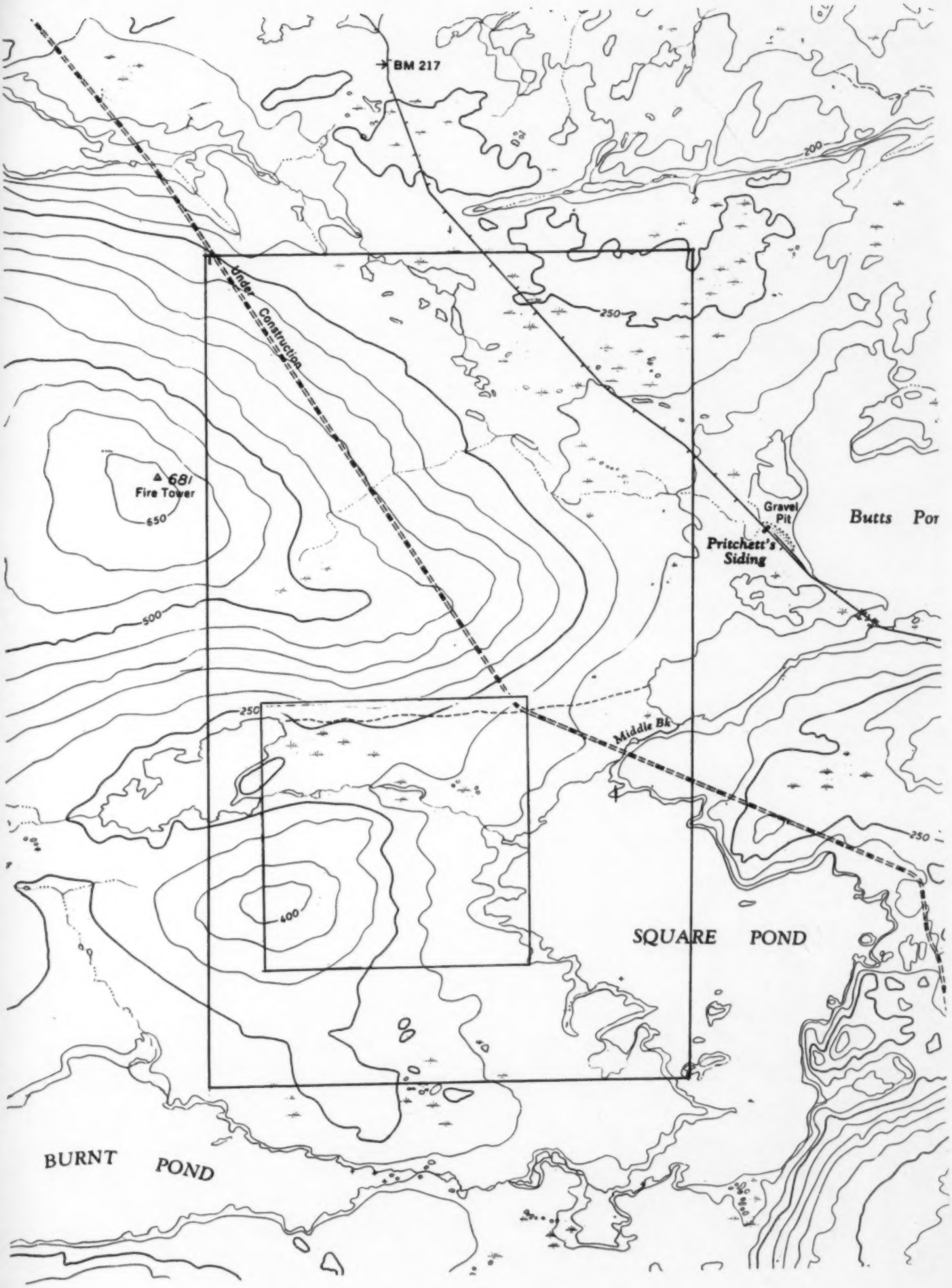
BM 217
200
250
Under Construction
681
Fire Tower
650
Gravel Pit
Pritchett's Siding
Butts Por
500
250
Middle Bk
250
400
SQUARE POND
BURNT POND

The Multiplex plotter. Its projectors give a stereoscopic image of the terrain shown in the pairs of photographs. It is used for tracing detail and topography onto the map manuscripts. N.F.B.

viewed at the same time allow us to recreate a miniature three-dimensional image of the object photographed. This stereoscopic model, tied to its proper position in space through ground controls, will present an accurate image of the original terrain, provided that the camera has been comparatively free from mechanical and optical distortions. Finally, when this model is established above a piece of flat paper, then traced on the paper, using perpendicular projections, the three-dimensional model is converted into a drawing of uniform scale, that is, a map.

Let us see how this theoretical description works in practice in the production of the 1:50,000 map.

The terrain to be mapped is photographed from the air with the camera pointing downwards as close to the vertical as possible. The plane is about 20,000 feet above the ground to give the scale of 1:40,000 ($f = 6$ in.). The camera exposure time-interval is set in relation to the speed of the aircraft to secure a 60 per cent overlap. This overlap from one photograph to the next gives a continuous series of stereoscopic pairs. The negatives obtained are 9″ by 9″. Small positive transparencies on glass are made from these negatives for use in the Multiplex. When the transparencies are placed in the individual projectors of this instrument, it is possible to obtain a stereoscopic model of the terrain photographed. The projectors of the Multiplex

are placed over a table on which lies a sheet of paper, representing the datum plane (usually sea level) to which plane the stereoscopic model has to be adjusted through ground control plotted on the paper or set on small tables. Once the adjustments have been made, the operator can trace out the contours, planimetric details, and so on. He uses a special table with a tiny illuminated opening, which functions as a floating mark, and a pencil placed perpendicularly under the floating mark. The table can be raised or lowered to any height of the stereoscopic model.

This pencil tracing is made on a scale about two and a half times larger than the photograph. It is reduced back to the scale of 1:40,000 by being photographed down by a precision camera. A contact print is then made on a special photographic material, in which the photographic emulsion is coated on white opaque plastic. It is to be noticed that this photographic step simultaneously accomplishes the reduction of the scale, and increases the inadequate contrast of the pencil tracing to a blackness comparable with that of the best India ink.

Finally these prints are assembled on a map projection, which is mounted on a sheet of aluminum to ensure dimensional stability. At this stage any necessary editing work is done — for example, colour inking for roads, forest coverage, names, and so forth — until the map manuscript is complete.

(*b*) *Reproduction*

The objective of the reproduction is to produce from the manuscript a map in full colour — black, blue, brown, green, red, and gray.

The maps are printed on offset presses. Each colour reproduced requires its own zinc or aluminum plate, which in turn is made from one or more negatives. The 1:50,000 National Topographic Survey maps, for example, are printed in two halves, each covering 15 minutes of latitude and 15 minutes of longitude. Each of these

The plate-whirler, used for coating plates, and plastic or paper sheets with sensitized dye.
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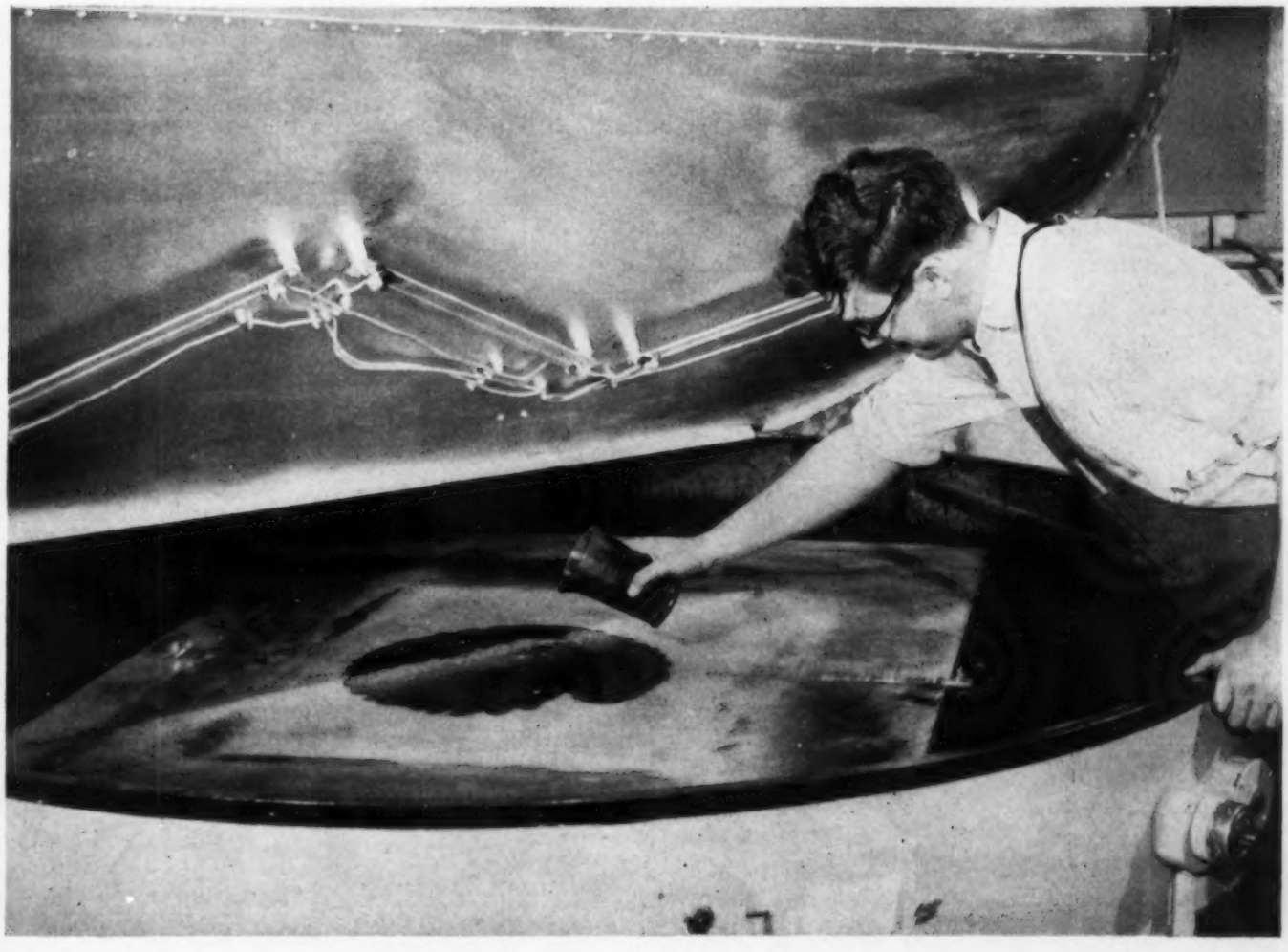
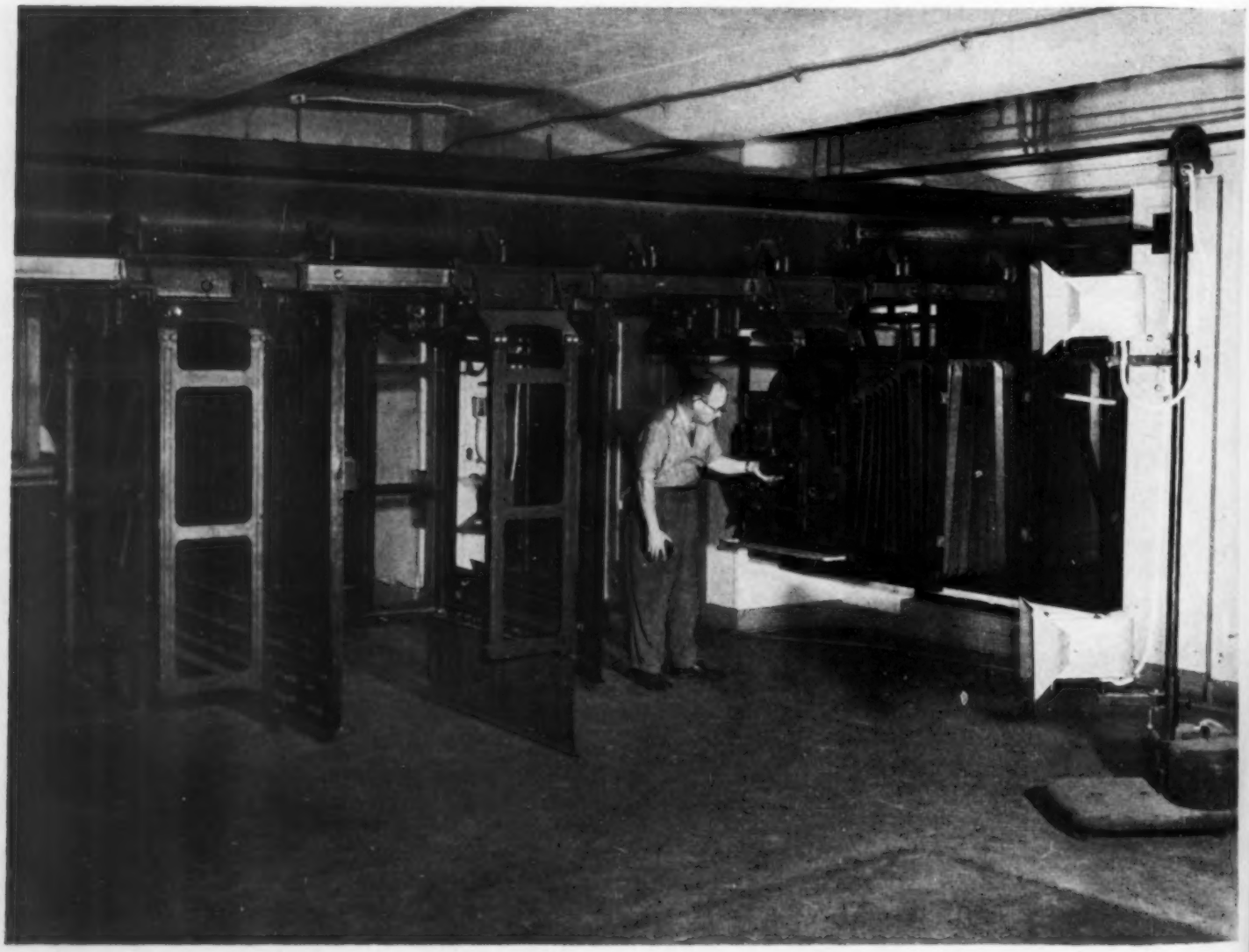


maps will require 10 to 16 negatives, all of which are prepared from one original manuscript.

It is in the method of preparing these negatives that a revolutionary change in cartography has recently been made. We are referring to the process called negative-engraving, which is speedily replacing the conventional smooth draughting on paper. A well-known European cartographer was recently somewhat shocked when, in reply to his question as to whether Canadian draftsmen could compare with their counterparts in European cartographic institutions, he was informed that in Canada even better maps are prepared by less experienced draftsmen, thanks to the new technique.

Again, photography plays an important role in the new process of negative-engraving. The first step towards producing the coloured map from the manuscript is the photographic reduction of the manuscript (1:40,000) to the publishing scale of the map (1:50,000). The film used for this purpose consists of a plastic base coated with a normal photographic emulsion. It is from this negative that the so-called "blue-line prints" are prepared on plastic sheets coated with yellow dye (yellow being a safe light for ordinary photographic emulsions). The blue-line print is a faithful image of the original manuscript; one such print is used for each negative to be engraved. Now the draftsman, using a number of ingenious engraving instruments, opens up the blue lines as he desires. He can regulate the weight of the line by varying the width of the blade or the sharpness of

The large and complex precision reproduction camera. It hangs from the ceiling. Its movements, all automatic, are controlled by push-buttons. Mines and Technical Surveys Dept.



the needle of the engraving instrument. In this way he engraves one negative for each of the following colours to be printed on the map: black (roads, buildings, boundaries, and certain conventional signs), dark blue (shorelines, rivers, streams, and marshes) and brown (contours and some conventional signs dealing with the third dimension on the map). When the process is completed, we have a set of engraved negatives, from which contact photographic positive transparencies are made on a plastic dimensionally stable base. Only the lines which have been opened up on the yellow sheet permit the passage of light, which will form black lines on the photographic contact transparency.

At this stage the names and numbers, which on modern maps are printed, not hand-drawn, are added to the positive print. The printing is done on thin transparent acetate on both sides to increase the opacity of the printed matter. The letters, words, or numbers can now be cut out, and affixed to the positive print. A photographic contact print from this positive provides the platemaker with his final line-negative.

The large areas of colour that are printed on the map require their own artificial negatives, which are prepared on transparent sheets of plastic. The areas to be printed in colour are covered with water-soluble opaque paint, and the whole sheet is dyed black. The patches of water-soluble paint are then washed off in water, giving an artificial negative ready for the preparation of the zinc plate.

Before the final plates are made, a photo-colour proof on an opaque white plastic sheet is prepared. The sheet is coated with a sensitized dye for each colour in turn, exposed to the appropriate negative, and developed. For good results, all exposures must be made in perfect registration. This photo-colour proof enables errors to be eliminated before the metal plates are finally prepared — a saving in time and cost.

If any changes in names, notes, or figures are necessary, the so-called "strip-film technique" is used. The corrected name is set up in type and photographed. The negative image on the photographic emulsion is stripped off the film base, and affixed to the map-negative.

The final application of photography in map-making occurs in the preparation of the metal plates. The offset plates are in fact prepared photographically. The ground metal plate is coated with sensitized albumen and exposed through the negative to a strong arc-light. In this way the plate becomes a photographic contact print of the negative.

It should perhaps be emphasized that we have not attempted to describe the entire process of making a map, but we have been attempting to highlight those aspects of map-making which are dependent on photography.

We have seen that the methods and equipment of the photographer and photogrammetrist are fundamental to practically every step in map-making, viz. ground or aerial photography for record purposes; aerial photographs for surveying; the copying camera for reduction; photographic blue line-printing instead of hand-tracing; photo-mechanical contact-printing in the handling of reproduction materials and in colour proofing; the use of the copying camera for stripping (corrections) and, finally, photo-mechanical contact-printing in the plating work. We could add a host of minor ways in which photography is used: in the provision of base maps of varying scales, photostatic copies for checking purposes, combined or single prints from the map-negative, and so on. All of these facilitate and speed up the work of surveyors, draftsmen, plate-engravers, and litho-printers.

It follows that progress in the field of map-making is very closely related to developments in the theory and practice of photography. Advances in the latter contribute to more rapid expansion in the mapped area of Canada and thus indirectly to the utilization of potential resources.

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Richardson's ground squirrel on the alert in the presence of an enemy. This animal was watching the movements of a weasel and giving an occasional whistle of warning.

The Gophers of the Prairie

by H. H. PITTMAN

Photographs by the author.

APPROACHING the great plains from the east or west is like entering another country, for everything is new and different and even if the change from some directions is gradual the effect is startling. The first impression is naturally one of unlimited space for the prairie extends to the horizon on every side and there is a sameness wherever one looks. This has a different effect upon different observers. To some it is monotonous, while others find in it a magnificence only rivalled by that of the ocean. It must have been a terrible ordeal for early travellers to cross the prairie with an ox-train, never staying long enough in one place to appreciate the beauty and so escape the monotony.

Residence or long familiarity is necessary to really understand and appreciate the prairie and its moods. For a month or six weeks perhaps, it is kindly, but generally it is stern and unrelenting, unwilling to extend a welcome until the stranger has proved his worth. It lacks the mellow warmth of the older settlements, for it is still unconquered. A continual struggle is necessary to keep the traces of man's work from being obliterated.

A vast area of land such as this, so individual and unlike anything on either side, may be expected to have a distinctive fauna and flora, and to a certain extent this is true. It was for centuries the home of the buffalo and the antelope; but these have almost disappeared

before the advancing thrusts of settlement, and the prairie animals of today are small. Of those most numerous on the great plains of Canada the ground squirrels are probably the most familiar. Ubiquitous and bold, they are known to everyone who has travelled across the prairie in summer.

Throughout the west ground squirrels are generally called gophers and are spoken of as bush or scrub gophers, brown and striped gophers, as the case may be. There are several other names in use, particularly for the commonest of them, Richardson's ground squirrel. The origin of the word, gopher, is difficult to trace, but there is a popular belief that the word was derived from the french *gaufre*, meaning honeycomb. Originally the underground chambers dug by the animal may have been referred to as *gaufres*.

In the early days, when cultivated fields were few and far between, gophers were even more numerous on the prairie than they are today. The settlers' grain plots provided the animals with a fresh source of food exactly suited to their needs, while the destruction of animals and birds that preyed upon them permitted them to multiply undisturbed. Subject to cycles of increase and decrease like many other rodents, they became very troublesome when their numbers multiplied. To protect the little plots of grain it was necessary to organize gopher extermination campaigns; these had to be continued for many years. Usually poisoned bait was placed at the entrances of all dens in the fields, on surrounding uncultivated land, and along road allowances. Today in most districts poisoning has been stopped, for while poison undoubtedly was effective against gophers, it also destroyed game-birds, cranes and other creatures unless very discriminately placed. Where I am writing, in the southeastern corner of Saskatchewan, their natural enemies, combined with trapping and shooting, seem to be keeping these rodents under control at present.

There are three distinct forms of ground squirrels on the prairie, all belonging to the genus *Citellus* and closely related yet curiously dissimilar in many ways. Interesting and graceful little creatures, they can be unmitigated and expensive pests, for they feed freely upon grain, seeds and fruits. They also eat eggs, including those of our game-birds, whenever an opportunity presents itself. When these have been too large to handle I have seen the animals search through a nest, select those that were chipping, adroitly remove their shells and eat the contents.

A closeup view of Richardson's ground squirrel. This is the common brown gopher of the prairie.

Richardson's Ground Squirrel

For many years the sandy-brown Richardson's ground squirrel (*Citellus Richardsoni*) was the one commonest in southern Manitoba, Saskatchewan and Alberta. Many a prairie serviceman while overseas has made this little creature the subject of tall tales for gullible listeners and has had it in mind when boasting that he owned a "gopher ranch." This is the gopher that has done most damage on the prairie and the one against which the poisoning campaigns were conducted. In some Saskatchewan communities a small bounty is still paid for its tail. Throughout the early days of settlement it was abundant, but during the past twenty years its numbers have been reported to be decreasing in many areas. The smaller striped ground squirrel seems to be taking its place. Richardson's is rather squirrel-like but is quite unable to climb. Although, like all the Canadian ground squirrels, it has but one litter a year, it seems to increase rapidly. In southern areas the six to eight young ones are born in May in a den which is usually several feet below the surface of the earth. It does not appear to make a special burrow for the nest as some rodents do, but utilizes one of the various underground chambers already excavated.

The main entrance to the burrow is usually made conspicuous by a small mound of earth which, coming from the subsoil, is often a different colour from that on the surface. However, the bolt-holes which may be four or five in number and thirty or more feet away in an old-established colony, are almost invariably concealed and very rarely have any earth around them. This habit of advertising by throwing up hillocks is confined to Richardson's ground squirrel, for its relatives even when living almost next door conceal their burrows, as a rule carefully carrying every particle of earth away. As it is inclined to be gregarious, there are places where a number of dens may be seen in a comparatively small area. Sandy knolls and ridges are popular but I have never found a large colony.

This animal has a large elastic pouch in each cheek opening into the mouth and may often be seen in autumn with these filled apparently to bursting point. Although in Saskatchewan it hibernates for nearly five months, it stores supplies of food for periods of scarcity or inclement weather. I have occasionally found underground chambers completely filled with wheat.

The call of this ground squirrel is a short but clear whistle which may vary a little in tone and even become pitiful when used as a warning about the presence of a weasel or any other enemy. I have noticed that there are sometimes two syllables in answering calls coming from the dens. Although easily intimidated, this little animal is very inquisitive. Often what appears to be a headlong flight ends somewhat abruptly at the entrance of the burrow. In short rushes near its home it frequently carries its short tail erect and when excited beats it rapidly on the ground, giving it a final derisive or defiant little whirl when disappearing. This habit is characteristic of Richardson's ground squirrel, and because of it the animal is often called the flickertail.

Like many of the desert animals, Richardson's ground squirrel obtains much of the moisture it needs from its food, but during abnormally dry seasons it will seek water. I once saw one go nearly half a mile to drink from a little pool below a pump in an otherwise dry ditch beside a railway grade. I had noticed it approaching and followed it when it left. This was a long and hazardous journey for a small

A cheek pouch from one of Richardson's ground squirrels. It is filled with wheat. The one-inch squares indicate the size of the pouch.

A striped ground squirrel. Slender and brightly marked, it is the most attractive of the genus.

animal but one that had apparently been undertaken before. It is popularly believed to dig a well in the lower galleries of its den but I have never had satisfactory proof of this. As it prefers light, well drained land, it seems doubtful that it has that habit.

The Striped Ground Squirrel

The slender striped ground squirrel (*Citellus tridecemlineatus*), averaging about fourteen and one half inches in total length, seems a more delicate, secretive and unsociable animal. It appears later in the spring and usually retires earlier in the autumn, although I once saw one in November in Saskatchewan. In the early days it was not generally as numerous as the brown one on the prairie, but even then there were places farther south where it was the common form and just as destructive and troublesome as Richardson's ground squirrel was here.

It is a very pretty little animal, inconspicuous in the grass where its bright markings blend with the lights and shadows in a manner almost unbelievable to anyone who has only studied it in a museum. For some time we encouraged three or four pairs to make their homes on our lawns because of their beauty and amusing habits. They had been there for several years before we realized how destructive they could be—the blame usually having been placed elsewhere. Banishment was reluctantly decreed, however, when they boldly accompanied my youngest daughter to the garden and

picked strawberries at one end of a row while she was gathering them at the other. Delightful to watch when at liberty and quick to appreciate protection, the animal makes a poor pet as a rule, for it will bite with little provocation. The bird-like call has two or more syllables and has been described as a trilling or trembling whistle. It often goes unrecognized.

During July it is amusing to watch one of these ground squirrels gathering material to refurbish its den. To say that it uses fine dry grass is an understatement, for every mouthful is chosen with meticulous care. To see one carrying a bundle with the ends projecting from each side of its mouth like a huge moustache is decidedly funny. These bundles sometimes present grave problems to it when the tiny entrance to the burrow is reached, for the opening is usually the exact size of its head. One summer day I noticed a narrow strip of lace trimming about eight feet long lying on the lawn, apparently dropped when some washing was carried in, and later I saw that it had been moved. Still later it was a little farther away and I could see that one end was in a hole. I gave the material a gentle pull which was immediately acknowledged by some sharp jerks at the other end. After I had repeated this several times an annoyed striped ground squirrel came out of an adjoining hole to see what was wrong. An hour or so afterwards the long strip of lace had completely disappeared.

One July day when my daughter and I were standing on the steps a striped ground squirrel followed by a very young one came up from the lower lawn. The elder approached in a series of short runs broken by pauses to allow the little one to catch up. The youngster was hungry and every time it reached its mother she would lie on her side and allow it to suck. After permitting it to rest for a minute or two she would run on for another four or five feet and again wait for it. This kept up until they reached a hole beside a Chinese lilac. We inferred that she had lost the rest of her litter and was coaxing the little one to follow her to a new home.

Franklin's Ground Squirrel

The largest member of the genus *Citellus* found on the prairie is the very handsome Franklin ground squirrel (*Citellus Franklini*) which has a length of about twenty-one inches

Four young striped ground squirrels playing near the entrance to the den. Although their markings are bright, they blend surprisingly well into the lights and shadows of their grassy habitat.

Franklin's ground squirrel is the largest and most squirrel-like of the genus. It is the only ground squirrel that does any climbing. This one has assumed a pose very much like that of a squirrel.

from nose to tail-tip and is the most squirrel-like of the genus. It frequents the edges of bushy or wooded areas and is the only ground squirrel that makes any pretence of climbing, by occasionally venturing into the lowest branches of bushes growing on sloping banks or beside ponds. I once coaxed one with some sweetly scented bait to ascend the gently sloping trunk of a dead tree where it could be photographed. Even when frightened it made no attempt to leap from the higher end and it was obviously ill at ease off the ground. This animal has buff or brown sides and a beautiful iron-grey back. The tail, normally flat, is decidedly bushy when the long hairs are erected.

Franklin's ground squirrel is inclined to be more secretive than the others and, although the loud syllabled whistle is often heard in suitable habitats, the caller may be unseen. It carries the excavated earth away from the den, rarely leaving any near the opening for very long, and the hole is often hidden by an overhanging branch or other vegetation. However on the edge of a garden the entrances to what seem to be temporary shelters are sometimes quite exposed. Six or seven young ones constitute an average litter in southern Saskatchewan. These animals do not show the variation in litter sizes so noticeable in Richardson's ground squirrel.

* * *

The ground squirrels can and sometimes do fight enthusiastically and viciously but the battles seem to be mostly over territorial rights and privileges. I have seen a striped one spend more than an hour endeavouring to drive an intruder out of its burrow and remain indifferent the while to my presence and the sounds made when a stand camera was being set up beside it. Unfortunately the shutter speed was too slow to record the battle and retreat but I observed that the intruder had tawny-red sides while the victor had the yellowish-brown ones common to this district. I also once saw a

Although cases of albinism and melanism seem rare among ground squirrels, this male albino was found on Moose Mountain in Saskatchewan. It is one of Franklin's ground squirrels.

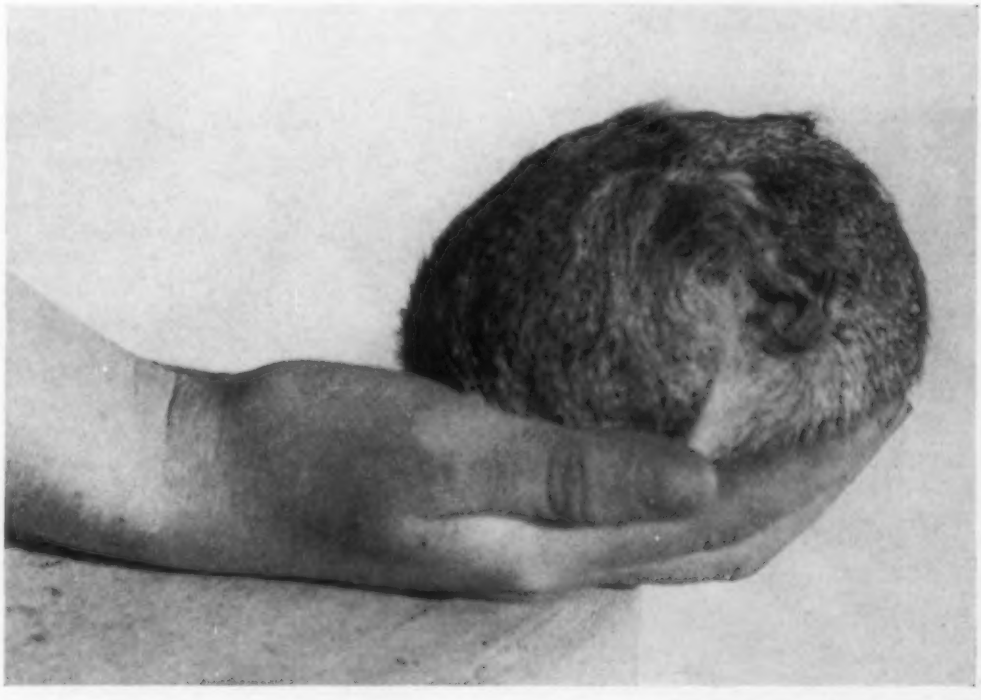
Richardson's ground squirrel fight and vanquish a long-tailed weasel emerging from a hole in a gopher warren.

All the ground squirrels like the little U-shaped burrows occasionally found on the prairie and these seem to be common property. Even if the entrance and exit are less than three feet apart, the shallow excavations afford temporary shelter in an emergency and a safe retreat in which to eat undisturbed. I knew of one beside a Saskatchewan garden where twenty-eight Richardson's, twelve or fifteen striped and two Franklin ground squirrels were caught in a few weeks as well as two grasshopper mice. These figures roughly indicate the proportion in which the animals occurred that year on this part of the prairie. Ground squirrels can be so destructive in fields and gardens that their few beneficial activities may be overlooked. Little thought is given to the weed seeds and insects they consume. There are periods in favourable years when their chief food consists of grasshoppers.

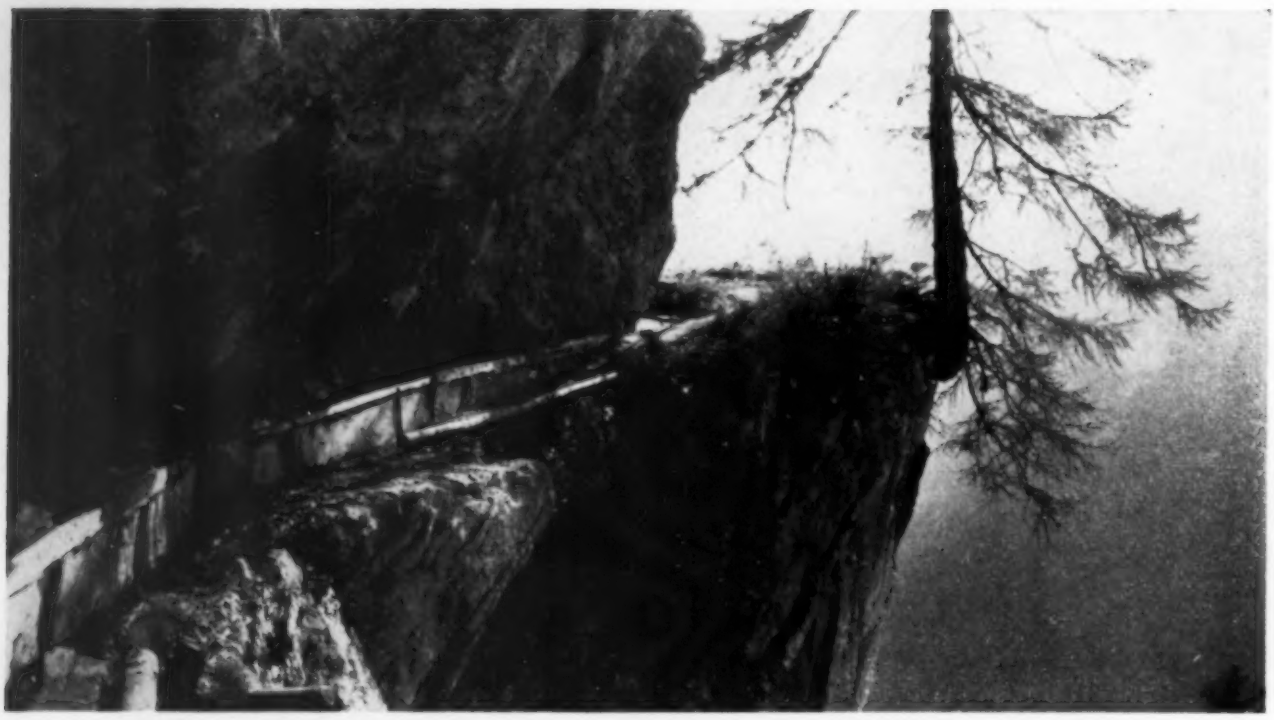
In the Prairie Provinces, where the winters are long and so severe that the earth may freeze to a depth of four or five feet, these animals hibernate, sometimes for as long as five months. The brown ones are almost invariably the first to awaken and may often be seen while there are still great drifts of snow on the ground. At such times food is scarce and they must depend largely upon whatever stores were secreted the previous summer. In midwinter they are rolled up in tight round balls with a temperature very slightly above that of the den and a heart-beat that is almost imperceptible. They appear to be dead. They may be rolled along the ground or used as a ball without awakening, and it is said that a limb can be amputated without blood appearing, as the circulation is practically at a standstill.

As with most animals, albinism and melanism occur, but the cases seem rare. I saw two white Franklin ground squirrels that had been snared on Moose Mountain in Saskatchewan some years ago and succeeded in photographing the male. Its coat was coarse and the tail was poor. The female was a better looking animal and when mated with the other produced five young ones, but unfortunately these were destroyed before their eyes opened. I have seen many hundreds of Richardson's ground squirrels but have neither seen nor heard of an albino. However, I receive occasional reports of black ones. There is a place near Brandon, Manitoba, where specimens of these have been found frequently. A few have also been recorded in western Saskatchewan.

The gopher has long been scorned, called pest and hunted down on the prairie. But it apparently has not earned universal opprobrium. Trieste recently issued a postage stamp bearing an excellent picture of one.



Franklin's ground squirrel continues the deep sleep of hibernation though held in a human hand. With its lowered temperature and faint heart-beat the animal seems dead.



The bisse of Roh above Montana starts at almost 9,000 feet and is thirteen miles long. This section at the 6,300-foot level hugs the mountainside as if making room for the tree with the precarious grip.

The Bisses of Valais, Switzerland

by DOUGLAS STEVENSON

Photographs by the author

Of all the twenty-two Cantons of Switzerland, Valais, the third largest, is the most picturesque. Here the summer visitor, who eschews the popular centres and rambles at peace on a high alp (mountain pasture) or in a quiet wood, may hear a queer, dull, regular tapping sound which will lead him to a really "off-the-beaten-track" discovery. He will come upon a narrow, artificial water-channel, called a *bisse*, and on it will see a thing like a wooden hand-made child's toy, operated by a small water-wheel and banging away lustily to itself. This device is a bisse-alarm, or *barrate*, and, striking on a board or flat stone, it lets the watchman know that all is well. It is the cessation of sound that warns of trouble—a reversal of usual alarms.

The silence of a *barrate* is ominous, for it

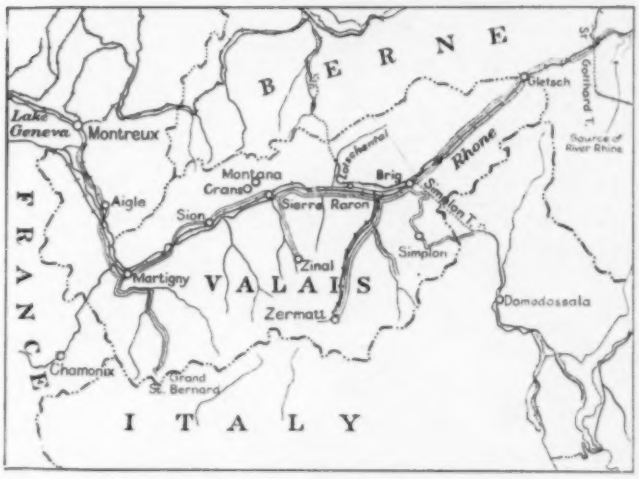
The bisse above Saas Fee at 7,000 feet. The parent glacier may be seen in the background.

indicates that water has ceased to run in the irrigation channel. Much of Valais owes its prosperity to that flow and in some areas the very means of existence depend on it. Since this Canton has the lightest rainfall in Switzerland, irrigation is an absolute necessity. Without it there would be no harvests from field, garden, and vineyard, and no nourishment for the thousands of cattle.

The *bisses*, unique to Valais, are interesting examples of the triumph of man's ingenuity over harsh natural obstacles. Each is a veritable little masterpiece of primitive engineering. Constructed across deep gorges and along the vertical faces of cliffs thousands of feet high, they bear life-giving water from the bases of glaciers to alpine meadows otherwise too sunny and arid to be productive. In the Canton there are over 200 of them with a total length of more than 1,100 miles. Their history is as ancient as that of the first settlements of Valais, for it is recorded that beside the first *bisses* bringing the "milk of the glaciers" to cultivated land rose the first units of communal life.

In certain regions like that above Sion, the Canton's capital, the channels bear water to land of three different types—alps where cattle graze in summer, village meadows and gardens, and vineyards. It is wholly due to *bisses* that such municipalities as Zeneggen, Vex, Lens and Savièse have prospered. Without irrigation the land around them would be as barren and desolate as, for example, similar areas in Montenegro and Albania.

Works of real engineering skill, whose construction often has exacted a toll in human life, *bisses* are known to have existed from Roman times. For hundreds of years they have been the object of general care and thought by the industrious Valaisans. As far back as 1552 the historian, Münster, stated that they were "to be found everywhere in the region" and referred to them as having been "in existence



C.G.J. map

South of Saas Balen at 4,500 feet lie these meadows, watered by bisses *flowing from a nearby glacier.*

Of freedom sings the glacier stream, of service the bisse *of Val Ferret starting here.*

Glacier stream (on right) and origin of two bisses *(B and C) in the Gredetsch Valley.*

Near Sierre the bisse *of Clavoz waters vineyards. The control path is on the right.*

A bisse flows through the village of Ausserberg in East Valais supplying the populace with water.

for centuries". The Cantonal Archives has official documents, dated 1342, regulating their use.

The creation of *bisses* is nearly always an extremely hazardous enterprise. Often they start from the very feet of glaciers at heights of 8,500 feet or more. (The *bisse* of Roh above Montana begins at almost 9,000 feet.) Their construction and upkeep present great difficulties, since the channels frequently must go across the faces of high cliffs, over moraines or landslides, and across gorges and overhangs. Seldom can they be dug at the higher levels. Often for mile after mile they must be hewn out of solid rock or supported by long retaining walls of masonry. Some have to be conveyed through tunnels, which may be up to three-quarters of a mile long. As these passages are rarely much more than three feet high, the men who do the work must kneel. In places where *bisses* have been wrecked repeatedly by landslides or avalanches, they now are suspended on long steel cables clear of the cliffs. A few shorter valleys without glaciers "of their own" are served by tunnel-bisses from adjacent valleys with ample water supplies.

Since 1932 some twenty new *bisses* have been built. The most important of these is the "Riccard". Others, ill-famed for loss of life, have been altered radically for safety's sake. On the Naters-Geimen *bisse* a dangerous section around a jutting cliff has been replaced by a long syphon. On that at Bitscheri, where a 547-yard suspended section caused several deaths, a tunnel has been constructed, the first large enough to serve also as a flume for timber from the forest higher up. On the Ste. Marguerite of Savièse a tunnel almost two miles long has been substituted for a perilous wooden section one mile long and nearly a mile up.

In several instances, as with the original Ste. Marguerite *bisse*, miles of rock ledge only a few inches wide have had to be chipped out of cliffs thousands of feet high by a workman whose assistant called out levels or signalled them from across the gorge. This exhausting work is done while the man dangles at the end of a rope perhaps hundreds of yards long. For the Gredetsch *bisse* one such rope measured 1,300 yards. Another difficult task is the bridging of deep gorges with perpendicular walls. The Clavoz *bisse* above Sierre has no less than seven bridges.

It costs a considerable sum to build a *bisse*. Maintenance, also, is expensive. The channels must be cleaned every spring and often during the summer as well. In many places exposed to avalanches the *bisses* must be taken up bodily or covered in for the winter. In

Starting point (X) of the bisse of Roh.

summer they must be inspected daily by a *garde-bisse*. (On the 20-mile Saxon *bisse* this watchman has his own small shelter-cabin, rather similar to those of isolated railway section-hands in Canada). The expenses of upkeep and inspection are covered by the sale of water. Any surplus cash goes towards improvements.

The regulations governing use of the system are very strict. A violation may lead to litigation between irate neighbours. Each member of the owning group is entitled to a share of water proportionate to his holding of land. Groups and individuals must wait their turn to draw water and may do so only for a specified time. The period may range from a half-hour for a small area to two weeks for a whole village's high alp pastures, which frequently extend for miles above the tree-line.

Distribution from the high pastures down to the tiny comb-and-finger rills in the diminutive valley meadows is controlled by a most ingenious system of dams, small primitive locks, and barriers. For the latter large flat stones or little guillotine-shaped iron sheets with a handle on the flat edge are used. Some of the larger *bisses* have sluices and sluice-gates. Some of the smaller branches are closed off at times with a thick piece of sod. Sand and pebbles are collected in settling-basins of cement.

The width of a *bisse* is governed by the nature of the terrain. It may vary from about a foot to over a yard. In several places, as at Hérémence or opposite St. Nicholas, five or six *bisses* may be seen close together, one above the other. This arrangement facilitates both flow and upkeep.

Sometimes small artificial lakes or "catch-basins" are used as reservoirs or to collect water at night to be released the next day. The lovely Illsee in the Anniviers Valley, the placid "lake" at Lens above Sierre and the one above Visperterminen are examples. (Incidentally, Visperterminen has the highest vineyards in all Europe because of its *bisse*, which starts ten miles south of the community at nearly 8,000 feet.) As so many irrigation channels have tapped their sources, many once flourishing streams like the Biedbach, the wild Gredetsch-bach, the Lonza, Prinze and Sionne are practically dried up in the summer.

The *bisses* easiest to reach, if a visitor should wish to trace their courses, are the 13-mile-long one at Roh near Montana, that at Lens near Crans above Sierre, and the lovely wood one of the Mayens above Sion. Near Grimentz in the Anniviers Valley on the way to Zinal there is

Bisse-control in a pasture near Sierre. In this case a simple wooden barrier was used.

Bisse *flows from left into a settling-basin. A control gate for a branch is in the centre.*

another which is utterly delightful. Its limpid sun-dappled water seems to enchant the surrounding pine forest, while its fresh coolness recalls the great regions of its source, the eternal ice of the Moiry Glacier.

The original *bisse* of Ste. Marguerite, fed by the Brozet Glacier, used to be the most spectacular and dangerous of them all. This amazing structure wound its giddy way for four miles along cliff-sides, clinging for over a mile to the perpendicular precipice above the east bank of the Morge River. Nineteen years ago, when we were setting off to "do" this *bisse*, the villagers were incredulous. They asserted that it never had been and never could be "done" by visitors and warned that, if we were so foolish as to try, it would end with disaster in the gorge. Some eight hours later, when we returned safely to the village inn, there was still more incredulity. It persisted until we had described correctly the worst of the five tunnels that we had traversed on all fours through ice-cold glacier water and most of the way in darkness. Then the inn-keeper presented us with a free bottle of the robust Valais wine, named *fendant*, which we shared with the congratulatory group.

This is how a section of the bisse *of Ste. Marguerite used to look at the 6,000-foot level before it was replaced by a tunnel. The dangerous structure was fastened to the sheer cliff with wooden pegs.*

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EDITOR'S NOTE-BOOK

Robert J. C. Stead (*Taming the St. Lawrence*), a member of our Editorial Committee, knows Canada from coast to coast and is himself known widely as the author of novels, books of verse, magazine articles, and numerous publications for government departments. At present Mr. Stead is conducting a class in creative writing at Ottawa's Carleton College.

* * *

Janusz J. Klawe (*The Role of Photography in Canadian Mapping*) is a graduate of the Universities of Grenoble and Glasgow who has done extensive research in optics, photography, and time studies. After lecturing in Applied Science for eight years at the University of Toronto, he was appointed Technical Assistant to the Chief Cartographer, Mines and Technical Surveys Department, Ottawa, in 1953, and held that position until March of this year. Recently he returned to Scotland to lecture at the University of Edinburgh.

* * *

H. H. Pittman (*The Gophers of the Prairie*) was born and educated in England. He was expected (he tells us) to enter the Civil Service, but his interest in natural history decided his future. When he first visited the Prairie Provinces years ago he was struck by their variety and abundance of wild creatures. He settled down in Wanchope, Saskatchewan, to study and photograph them, and over the years has amassed a fine collection of pictures and much interesting information.

* * *

Douglas A. Stevenson (*The Bisses of Valais, Switzerland*) has spent a great deal of time in Switzerland and other European countries. After five years of overseas service during World War I, he was appointed to the International Labour Organization of the League of Nations in Geneva. He remained there until 1940 when he joined the staff of the War Office in London. Three years later he was appointed Public Relations Officer for Ontario House in London. He has now retired and lives at Fonthill, Ontario.

Melbourne's Exhibition Building, the largest and one of the most historic buildings in Australia. Some of the Olympic competitions will be held there next year. Australian Dept. of Information

Looking Ahead Down Under

Only four countries have competed in every Olympic Games series of the modern era. That Australia is one of them indicates what enthusiasm for sport prevails among her people. In 1956 this enthusiasm will be given a very special means of expression, for the Olympic Games will be held for the first time in an Australian city. From 22 November to 8 December Melbourne will play host to between 5,000 and 6,000 athletes and thousands of spectators, many of them from overseas.

Melbourne is situated on the coast near the south-eastern tip of Australia at the head of Port Phillip Bay. The city, which is 120 years old and the second largest in the country, covers 250 square miles and has a population close to 1,400,000. Its climate is temperate, averaging 67 degrees Fahrenheit in summer and 50.3 in winter. It is a quiet city with many wide streets lined with ornamental trees and numerous attractive parks and gardens. The outlying countryside, which has been described as Australian bush at its best, is hilly, in places heavily wooded with mountain ash.

Melbourne's greatest natural asset is Port Phillip Bay, an almost completely land-locked expanse of water covering about 720 square miles. Because of this fine harbour, Melbourne has a busy waterfront visited by ships from all over the world. During the warm weather, which lasts from October till May, many of the city's residents swim and sail in the Bay. There are twenty-five yacht clubs scattered along its shores. To support its claims to cultural achievements, the city offers ballet, opera, theatre, and a symphony orchestra. Its fame, however, rests more securely on the Melbourne Cup Race, Australia's most important sporting event, held every year at the Flemington Racecourse on the first Tuesday of November.

Although two or three new hotels are being built, it is expected that hotel rooms will be at a premium during the 1956 Olympic Games. Between 8,000 and 15,000 visitors are expected to arrive from overseas for the occasion — far too many to accommodate in the limited hotel space. The Civic Olympic Committee consequently has arranged for a large number of people to be taken into private homes. The head of this committee has issued an assurance that no visitor from abroad need worry about being unable to obtain accommodation.

The Olympic Games appear to have originated as a religious festival in ancient Greece. It is known that they were held at Olympia from 776 B.C. till A.D. 394 when they were abolished by Theodosius the Great. Centuries passed, and Olympia fell into ruins. It was only in the last quarter of the nineteenth century that the city was excavated. A French educationist, Baron Pierre de Coubertin, on visiting the excavation site conceived the idea of reviving the Olympic Games. By encouraging participation in sports, he believed the physique of his countrymen could be improved.

(*Continued on next page*)

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ALUMINUM COMPANY OF CANADA LTD. (ALCAN)

(Continued from previous page)

However, as the Baron travelled from country to country studying and comparing methods of organizing sport, his original idea broadened and he envisioned the international competition as a means of promoting a spirit of brotherhood among the nations. In 1894 an International Olympic Committee was formed. In 1896 the first of the modern series of Olympic Games was held in Athens. They have been held every four years since then with the exception of the years 1916, 1940 and 1944 when the nations of the world were too busy fighting to be interested in fraternal meetings or classical competitions.

The symbolic Olympic flame will be kindled at Olympia about three weeks before the games next year and will be flown from Greece to Cairns on the north-eastern coast of Australia. From there the torch will be borne southward by a relay of about 2,500 runners to Sydney, then inland to Canberra, and on down to Melbourne — a distance of over 2,550 miles. The Olympic Games will commence with the arrival of the torch at the Melbourne Cricket Ground, location of the Main Olympic Stadium.

Thousands of athletes, representing some seventy individual countries, will take part in the 150 different events that are scheduled. At Heidelberg, seven and one-half miles from Melbourne, an International Olympic Village is being built to house them. Covering 117 acres, it will consist of 700 brick and concrete houses and flats with all the amenities of the modern residential suburb that it is destined to become after the games. It is to be completed by next June.

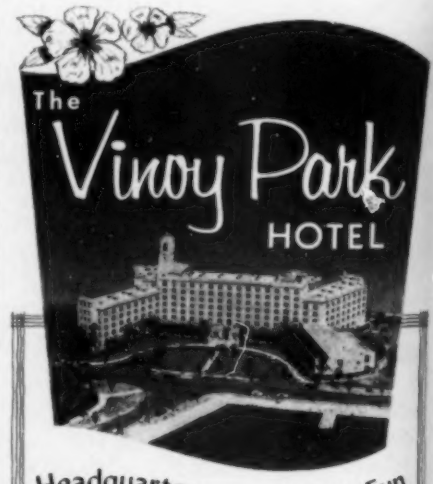
Most of the buildings in which the various events are to be staged are within about one mile of the heart of the city. The famous Melbourne Cricket Ground, which is to serve as the Main Olympic Stadium, is near the Yarra River in an attractive park easily reached by road or tramway. Its grandstand has been remodelled to seat 120,000 spectators. Not distant from it and next to it in importance is Olympic Park. Here twenty-five acres are being transformed into a sporting centre which will have a new 25-metre swimming pool and diving stadium with space for 5,500 spectators, a velodrome for cycling events, and athletic fields. Basketball games and gymnastic competitions will be held in the Glacarium, a skating rink with a special floor for the occasion. Fencing will be done in the ballroom of the Town Hall at St. Kilda, a bay-side suburb of the city; rowing and canoeing contests will take place on Lake Learmonth near Ballarat, seventy miles west of Melbourne; shooting competitions at the Williamstown military rifle range; and sailing races on Port Phillip Bay.

A large number of seats have been reserved for overseas visitors for the different events and for the opening and closing ceremonies. Every day during the games 40,000 to 45,000 tickets will be sold for standing room, so late-comers will not be entirely out of luck. Tickets may be obtained through the transportation companies serving Australia and through Canadian travel agencies. The latter also will arrange accommodation. Those who prefer to make their own arrangements may do so by writing to the Civic Olympic Committee, Town Hall, Melbourne, Australia.

Apart from the passenger vessels of the Orient Line sailing to Australia from Vancouver and San Francisco, the only ships going there from this continent are freighters with limited space for passengers. The airlines operating between North America and Australia are Qantas Empire Airways Limited, Canadian Pacific Airlines, and Pan-American Airways.

Southern Tourist Flights For T.C.A.

Early this month Trans-Canada Air Lines expects to introduce an all-



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tourist class service from Toronto and Montreal to Tampa, Florida, the islands of the Caribbean and Bermuda. The company's North Star aircraft will be used for the purpose. The 27 per cent reduction in fares will result in substantial savings for passengers, and there will be 32 per cent more seats available.

During the mid-winter season, when the demand for space on aircraft flying south is heavy, T.C.A. will have nine flights a week to Tampa. An increase in the frequency of flights to Bermuda and Nassau is expected also.

British Industries Fair 1956

Anyone wishing to attend the 1956 British Industries Fair might like to make a note of the dates for the two halves of the Fair. The first part will be held at Earls Court, London from 22 February to 2 March, and the second at Olympia, London and Castle Bromwich, Birmingham from 23 April to 4 May.

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(United Kingdom Information Office, Ottawa.

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We are always glad to extend a warm welcome to the publications of the United Kingdom Information Office, and this time the Official Handbook of Britain contains many new and attractive features, including an excellent coloured fold-in map at the end and coloured diagrams. The illustrations of the social and industrial life of the country are well chosen and informative, and the accompanying text is very clearly set forth and well printed.

The sections on the defence systems and on industry make very interesting reading, and the headings printed in heavy type help the reader to grasp the situation quickly. The volume of information is very extensive, but the reader can find his way around without any hesitation owing to the excellence of arrangement and careful indexing. This is an excellent addition to the Office's series of handbook publications.

SYLVIA SEELEY

* * *

East Africa Royal Commission 1953-1955 Report

(United Kingdom Information Office, Ottawa.

$2.00 cloth, $1.40 paper)

This report of the Royal Commission on East Africa is a very important contribution to public under-

(Continued on next page)

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(*Continued from previous page*)

standing of that little known region. The very name, East Africa, conveys little enough to the average reader, but in this report all the tremendous problems and difficulties of this vast territory become alive and full of absorbing interest. Every aspect concerning population, natural resources, trade, finance, and administration is set forward with meticulous care, and presented in most readable form. The vast questions connected with labour, health, and social development have been the subject of infinite care and research in order to further the prosperity of this part of the Commonwealth.

The last few pages of the report are devoted to an admirable and clear-cut summary of each chapter, together with the main conclusions and recommendations, and one's comprehension is further helped by a series of four maps (folded in a back pocket) which are notable for their clearness and purpose. SYLVIA SEELEY

* * *

Humboldt

by Helmut de Terra

(McClelland & Stewart, Toronto, $6.50)

Perhaps there is no record of any man who crowded so much valuable work into ninety years as did Alexander von Humboldt. The range of subjects in which he could be strictly described as an expert shows a versatility of mental powers for which it would be hard to find a parallel. Like many a pioneer in the realms of science, the brilliance of his original discoveries and observations has been somewhat obscured by the success of his eager followers who have built upon his foundations, extended his methods, and are still turning his distant hopes into practical realities. Humboldt was born in Berlin, 1769, and twenty-three years later started his public career as government Inspector of Mines, applying his knowledge not only to improving mineral production, but also to improving the conditions under which the miners worked. A social conscience was rather an innovation in the eighteenth century, but Humboldt was just as active in this respect as he was in the fields of geology, botany, chemistry, physiology, and everything that pertained to the physical harmony of the universe. Endowed with a constitution that took him through the tropical forests of South America, nearly to the summit of Mount Chimborazo (over 19,000 feet), he never lagged in recording his observations with minute care, or in making measurements of an accuracy hitherto unattained. He was artist enough to illustrate his

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work with his own hand, as two of the illustrations in this book testify. Later he explored the frozen plains of Siberia in search of mineral wealth for the Russian government. No wonder that such a man should discuss the possibility of a Panama canal with the poet Goethe, correspond on oceanography with young Charles Darwin, and argue for the abolition of the West Indian slave trade.

Obviously it is no light task to write the life of a man who presented so many brilliant facets to the world. Mr. de Terra has covered this unusually wide field with the appreciation of a fellow scientist, and has added a useful appraisal of Humboldt's contributions to human knowledge under the headings of the ten subjects wherein he was master; there is also a bibliography of Humboldt's chief writings. One could wish that the author had refrained from sprinkling his text with certain colloquialisms, which are unbecoming to so dignified a subject.

SYLVIA SEELEY

* * *

Ahoy There!
by Will Dawson
(J. M. Dent & Sons (Canada) Limited Toronto, $3.50)

Who has not at one time or another felt the call of the sea ? Who has not felt the urge to leave the bustling city behind and to wander at will across the sea lanes of the world or some small part of it ? For most of us such wishes must remain as dreams but to Will Dawson and his wife they became realities. In a most entertaining book Mr. Dawson illustrates that going down to the sea in ships, especially in small ones, is not all pleasure, but involves a great deal of hard work and attention to details. As a counterbalance to these aspects of sea life, there is freedom to wander where one pleases—tide and wind permitting; interesting out of the way places to visit; and above all a colourful panorama of scenery and people to visit and observe.

Places and people visited during several years of cruising along the coast of British Columbia provide the basis of this book. The Dawsons sailed out of Vancouver harbour each spring, turned their boat westward under Lion's Gate Bridge, passed the westward stretching arms of the metropolis, and headed the 'West Wind' out into the Gulf of Georgia. From spring until late fall or early winter when bad weather forced them back to Burrard Inlet, they sailed up and down the coast, into small bays, around islands, and across stretches of open water.

Any lover of travel literature will enjoy this account of sea voyages. Tussles between the Dawsons, their boat and the weather, fascinating anecdotes of places visited and people talked to, interwoven with some penetrating observations on human nature, provide an enjoyable evening of reading.

More pictures by the author and fewer by commercial agencies would have added to the appeal of this book. Routes of the voyages plotted on the map would have been a help to those Canadians not fortunate enough to live on the West Coast to find their way around the inlet-cut, island-dotted coast.

GORDON D. TAYLOR

* * *

Results and Problems of Modern Geographical Research
(In German)
Edited by Kurt Brüning
(*Published by Walter Dorn Verlag, Bremer-Horn. Vahrerstrasse 359, Bremer-Horn, Federal Republic of Germany, $3.95*)

This is an anniversary publication on the occasion of the 60th birthday of Hans Mortensen, an eminent German geographer. It consists of four parts to which his students, friends and co-workers have made valuable contributions. Part I is dedicated to the life and work of Mortensen, while the other parts contain many highly interesting articles with very good illustrations and maps. Part II consists of articles on the study of physical geography, Part III contains articles on anthropogeography, and Part IV articles on the geography of individual countries.

Hans Mortensen was born on 17 January, 1894, in Berlin. In 1927 he was appointed as a professor at the University of Göttingen and in 1931 at the University of Freiburg. Since 1935 he has been professor of geography at the University of Göttingen. Mortensen has published a large number of articles and papers on a variety of subjects, such as general geography, cultural geography, morphological geography, and so on.

H. A. G. NATHAN

(*This book may be obtained duty free, direct from the publishers at Bremer-Horn, and may be paid for in Canadian dollars.*)

* * *

The Gyr Falcon Adventure
by Stanley Cerely
(Collins, Toronto. $4.00)

This delightful book shows what can be done with a three-week holiday by an enthusiastic bird-lover. In

(*Continued on next page*)

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(*Continued from previous page*)

searching for information about the gyr falcon, fiercest of all the tribe of hawks, one would not expect to find it in the Bank of England, and yet it was within those august walls that Mr. Cerely, amateur ornithologist, first dreamed up his idea of making his annual holiday a one-man trip to the frozen fastnesses of Iceland, in order to learn more of this royal bird of prey, and to obtain photographs at close quarters. He tells us that he had no telephoto lens, and had therefore to be prepared to meet his quarry face to face, that is, within striking distance of the raptorial beak and talons.

Timing his vacation carefully to coincide with the nesting period of the gyr falcons, he arrived by unconventional paths on a desolate promontory of northwest Iceland. His descriptions of the friendly help that he received, and the skill of his English-speaking native guide add much local charm to his tale. There were plenty of difficulties in transport, and dangers in seeking the eyries of the gyr falcons, but the unique photographs with which the book is illustrated are proof enough of the author's courage and pertinacity. His previous experience as a mountain climber must have stood him in good stead in scaling the precipitous ledges where the young eyases are raised; he has made his own independent contribution to the science of wild bird life.

In addition to a thrilling ornithological adventure, the book gives us a brief and friendly glimpse of Iceland and her people. The obstacles of language, and of travelling over unmade roads in sparsely populated regions, are all recounted with a light hearted charm, which encourages the reader to believe that the most fantastic day-dreams can be brought to fulfilment by anyone who is sound in wind and limb, and fired with enthusiasm.

SYLVIA SEELEY

* * *

The Story of a Province
A Junior History of Saskatchewan
by John Archer and A. M. Derby
(McClelland & Stewart Ltd., Toronto, $3.00)

To mark the Golden Jubilee of Saskatchewan in 1955 J. F. C. Wright compiled *Saskatchewan, The History of A Province*. It was decided that an adaptation of the book for school purposes would be a valuable addition to the main work. The result of this decision is the volume under review.

(*Continued on page XV*)

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(*Continued from page XIII*)

This book traces the development of Saskatchewan from its earliest days to the present. The colourful story of settlement—from Indian to oil worker and uranium prospector—is told in delightful fashion. There are many thrilling episodes in the opening of a new country, and the settlement and growth of the Canadian prairies is no exception. Fur traders and adventurers pioneered the route to the west. They were followed later by Metis. Then came the agricultural settlers, the merchants, and the host of people required to make up a modern civilized community. The social problems encountered in moulding the various elements into a cohesive whole were sharpened by the political problems of shaping an administrative unit, and by the economic problems of growing and marketing wheat, which became the basis of the province's economy.

The authors have taken these elements and have welded them into a highly readable account of the growth of Saskatchewan. Greater emphasis could have been placed upon the living conditions faced by the pioneer settlers. It is necessary to know how people live and how they spend their spare time, if we are to appreciate the true character of an area. In this connection one other point might have received more attention. The role of the European immigrants is of great importance in the settlement of the prairies. More might have been said of them in this volume.

The book is well illustrated with maps and sketches, and is bound with a most attractive cover.

GORDON D. TAYLOR

* * *

Outside Readings in Geography
by F. E. Dohrs, L. M. Sommers and D. R. Petterson
(Thomas Y. Crowell Co., New York, $2.95)

The purpose of this book is to "make available under one cover a wide range of selections" from geographical literature. The compilers have gathered together eighty-six articles written by authors from six countries. Accompanying each paper is a brief biographical note indicating the qualifications of the writer. Some papers have been edited to make them more readily understandable by the public.

The articles are arranged systematically under twelve major headings. Examples of these are: Weather and Climate, Soils and Agriculture, Mineral Production, and Population and Settlement.

This book should find a ready welcome in the growing library of geographical literature. It brings together in one volume many of the classics of the field. It will provide students with a ready source of valuable outside readings. If it serves further to stimulate their desires for further reading, as the editors hope, it will have done a useful service.

An interesting feature of this volume is a table correlating the articles with pertinent chapters of fifteen standard introductory texts in geography. It should also be noted that the price should place the book within financial reach of all students.

GORDON D. TAYLOR

* * *

The Ascent of Alpamayo
by Georges Kogan and Nicole Leininger
Translated by Peter E. Thompson
(Clarke, Irwin, Toronto, $3.15)

Books on mountaineering are apt to have a close family resemblance, so it is very refreshing to find one which records at least three features which are unique and important. The sub-title informs us that it is an account of the Franco-Belgian expedition to the Cordillera Blanca in the high Andes, a mountain mass extending about one hundred miles through the tropics, and concerning which nothing was known till the beginning of the present century.

This singularly happy mountaineering party had no leader and the two chief members, Georges Kogan and Raymond Leininger, were accompanied by their wives. The second part of the book is written by Madame Leininger who turns the stern realities and dangers of mountain climbing into a joyous venture as she follows her slight young companion, Madame Kogan, on the rope up the slopes of Quitaraja and together the two women make a purely feminine conquest of a twenty thousand foot mountain peak for the first time in history.

Another happy feature of this story is the freedom from mishap, in spite of all the dangers inherent in such an expedition. The authors have a special felicity in the way in which they bring home to the reader the adventures of daily life at great altitudes; one cannot help sharing in spirit all their joys and difficulties and rejoicing with the whole party when they achieve their main objective, the conquest of Alpamayo, whose perfectly triangular cone of ice seems to justify its claim to be the most beautiful mountain in the world.

The book is very well illustrated, and to read it is a most pleasant adventure in vicarious mountain climbing.

S. SEELEY

(*Continued on page XVII*)

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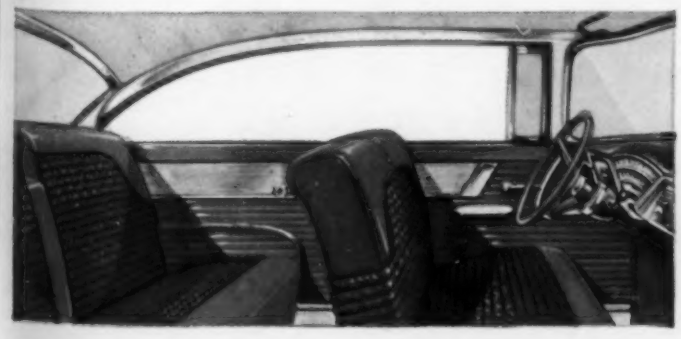

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Physical Geography and Climatology
by N. K. Horrocks
(Longmans, Green and Co., Toronto, $3.25)

A book on physical geography raises a question as to the place of the subject within the field of geography. There are several different lines of thought on this matter. British geographers have tended to place a great deal of emphasis on physical geography as physiography. Certain schools in the United States view physical geography as a geography of natural resources. In these schools geomorphology is considered to lie within the province of geology. Physical geography properly constituted should contain elements of both viewpoints. It is necessary to know the processes involved in the formation and occurrence of physical phenomena; it is also necessary to know the distribution of these elements and their relationship one with another and with human activity.

If we view physical geography from this all inclusive standpoint, the present book falls short of describing the field. If we take a narrower view then this book should adequately fulfil the goal set for it by the author. To illustrate the difference between the two points of view, look at the map on page 55 and ask, is it more important for a geographer to know that the Central Plains of North America are of Hercynian and other mountain structure, or that they are a vast area of nearly level fertile land.

This is a book written by a British geographer and intended as a text in the higher grades of secondary school. The material is presented in a concise and simplified form and yet it covers the basic principles very well. Illustrations—photographs, line drawings, and graphs—provide useful and necessary supplements to textual material.

Most writers on physical geography fail to take man into account as a geographic agent. In many parts of the world man has played a significant role in modifying the physical environment. Mr. Horrocks recognizes the impact of man but could have placed more emphasis on that aspect of his subject.

The material is treated systematically with sections devoted to structure, earth sculpture, meteorology, plants and soils, climatology and oceanography. In each section the major forces which have shaped the characteristics of the earth's surface are discussed, and an analysis made of their effect. Oceanography is a worthwhile addition to a book of this nature. One might well ask, however, if minerals, water power, and animals are not also part of physical geography.

This reviewer feels certain that many a college professor of geography would be gladdened if his students arrived from secondary school with a basic knowledge of the earth such as this book provides.

GORDON D. TAYLOR

* * *

Geology of Olympic National Park
by Wilbert R. Danner
(Published in co-operation with the Olympic Natural History Association, University of Washington Press, $1.25)

The Olympic Mountains form a wilderness of rugged beauty occupying about 4,000 square miles in the north-western corner of the State of Washington. The highest ridge is that containing Mount Olympus whose greatest elevation is 7,954 feet above sea level. In the park there are some fifty glaciers, six of which are each over a mile in length.

The volume describes the geology of the range and coastal border in simple terms so that, aided by the excellent photographs and diagrams, the layman can readily follow the story. The oldest rocks exposed are of the Lower Cretaceous age. They were folded and uplifted during the Upper Cretaceous. In late Upper Cretaceous and earliest Tertiary time the region suffered erosion. By Eocene time it had been reduced to low relief. Subsidence then occurred and the sea extended over the area. Sediments accumulated as well as a great thickness of volcanic rocks. The later Tertiary history is a varied story of uplift and subsidence and advances and retreats of the sea. During the Upper Pliocene and Lower Pleistocene the Cascadian revolution took place, folding and faulting the strata and producing the present Olympic Mountains.

The Pleistocene history was marked chiefly by the sculpturing by glaciers and probably also by continued uplift. Snowfall is still heavy. It has been estimated that on Mount Olympus it amounts in some years to as much as 200 feet.

Mineral occurrences that have attracted attention include manganese showings associated with volcanic rocks. Two areas of hot spring activity occur in the northern part of the park. The park includes a coastal strip about a mile wide, running for 50 miles along the Pacific. It is a rocky shore of cliffs and islands. Here during the Pleistocene there were several episodes of sediment deposition. There were also crustal movements with the result that some of the Pleistocene sediments have been gently tilted and folded.

F. J. ALCOCK